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AUTHOR	Lovaas, O. Ivar; And Others
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ABSTRACT

Reported was a behavior therapy program emphasizing language training for 20 autistic children who variously exhibited apparent sensory deficit, severe affect isolation, self stimulatory behavior, mutism, echolalic speech, absence of receptive speech and social and self help behaviors, and self destructive tendencies. The treatment emphasized extinction of pathological behaviors through reinforcement withdrawal, aversive stimuli, or reinforcement of incompatible behavior, and language training. Measures of change included multiple response recordings of self stimulation, echolalic speech, appropriate speech, social nonverbal behavior, and appropriate play, along with Stanford Binet Intelligence Test and Vineland Social Maturity Test Scores. Results were given as group averages followed by extensive discussions of changes in individual groups and children. Findings were summarized as follows: pathological behaviors (echolalia, self stimulation) decreased while desired behaviors (appropriate speech, play, social nonverbal behavior) increased; all children improved, some more than others; followup measures 2 years after treatment showed large differences depending upon the posttreatment environment; and reinstatement of therapy reestablished original therapeutic gains in the institutionalized children. (GW)

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SOME GENERALIZATION AND FOLLOW-UP MEASURES ON AUTISTIC CHILDREN IN BEHAVIOR THERAPY[1]

O. Ivar Lovaas, Robert Koegel, James Q. Simmons, and Judith Stevens

University of California, Los Angeles

ABSTRACT

We have treated 20 autistic children with behavior therapy. At intake, most of the children were severely regressed, having symptoms indicating an extremely poor prognosis. The children were treated in separate groups, and some were treated more than once, allowing for within and between subjects replications of our treatment effects. We have employed reliable measures of generalization across situations and behaviors as well as across time (follow-up).

The findings can be summarized as follows. (1) "Sick" behaviors (echolalia and self-stimulation) decreased, while "healthy" behaviors (appropriate speech, play, social non-verbal behavior, IQ scores and Vineland social quotient scores) increased. (2) There were no exceptions to the improvement, but some of the children improved more than others. (3) Follow-up measures taken two years after treatment showed large differences depending on the post-treatment environment. Children whose parents were trained to carry out behavior therapy continued to improve, while children who were institutiionalized regressed. (4) A brief reinstatement of behavior therapy could re-establish the original therapeutic gains in the institutionalized children.

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SOME GENERALIZATION AND FOLLOW-UP MEASURES ON AUTISTIC CHILDREN IN BEHAVIOR THERAPY

O. Ivar Lovaas, Robert Koegel, James Q. Simmons, and Judith Stevens

University of California, Los Angeles

The generality of treatment effects can probably best be evaluated through three measures: (1) stimulus generalization, the extent to which behavior changes which occur in the treatment environment transfer to situations outside that treatment; (2) response generalization, the extent to which changes in a limited set of behaviors effect changes in a larger range of behaviors; and (3) generalization over time (or durability), how well the therapeutic effects maintain themselves over time (Baer, et al., 1968).

Over the last five years we have seen 20 autistic children with the purpose of developing behavior therapy programs conceived within reinforcement theory (operant conditioning therapy). Before we present our data on the overall clinical improvement in these children, the reader should know that the treatment program was carried out with a heavy research emphasis which placed limits on immediate therapeutic effectiveness. Because of its research base, the program focused on a limited set of interventions for a limited set of behaviors. We have emphasized speech training and somewhat neglected training in nonverbal imitation, even though the children might have benefited more by a reversal in that emphasis. Similarly, our concern with obtaining reliable data has necessitated temporarily withholding treatments to better assess their potential effectiveness, thereby slowing up the child's progress. When we started seeing patients in earnest in 1964, behavior therapy with psychotic children was new. In fact, on the first four children, we constructed and tested new

treatment programs on an almost daily basis. We did not employ a staff which could have facilitated foster home placement (when this was necessary). Our treatment environment was restricted. For example, we did not maintain liasion in the community with a special school which could have implemented our program. We also had a time limit on treatment. Finally, with one or two exceptions, we selected children with the poorest prognosis.

With these reservations in mind we will present our measures on generalization and follow-up since these will provide some approximation of changes one might expect in psychotic children undergoing behavior therapy. The data probably give an underestimate of the benefits which one might expect.

Method

Subjects. We have treated a total of 20 children, all of whom have been diagnosed as autistic by at least one other agency not associated with this project. However, the majority of the children had more than one diagnosis, usually also being referred to as retarded and braindamaged. Since there is considerable behavioral heterogeneity among autistic children, it is appropriate to describe the children we have treated in more detail. First, we have treated the undeveloped children, that is, children who would fall within the lower half of the psychotic continuum, and whose chances of improvement were considered to be essentially zero. Most of the children had at least one prior treatment attempt (other than behavior therapy) which proved to be ineffective in helping them. Most of the children have been rejected from one or more schools for the emotionally ill or retarded because their teachers could not control the, and their behavior was so bizarre that it was disruptive for the other children in the class. Clinically speaking, with three or four exceptions, they seemed void of anxiety, and none had any awareness that something was wrong with him.

Generally, the children we have treated can be described as showing the following characteristics. (1) Apparent sensory deficit, which refers to the fact that most of the parents have described their children on the Rimland Checklist (Rimland Diagnostic Checklist for Behavior-Disturbed Children, Rimland, 1964) as: (a) at one time appearing to be deaf; and (b) looking through or walking through things as if they weren't there. Furthermore, many of the parents have at one time sought professional opinion about their children's hearing and/or vision, discovering that the child had "normal" hearing and vision. (2) Severe affect isolation was predominant, meaning that the parents have described the children on the Rimland Checklist as: (a) failing to reach out to be picked up when approached by people; (b) looking at or walking through people as if they weren't there; (c) appearing so distant that no one could reach them; (d) indifferent to being liked; and (e) not affectionate. (3) There was a high rate of self-stimulatory behavior, which refers to behavior which appeared only to provide the children with proprioceptive feedback (e.g., rocking, spinning, twirling, flapping, gazing, etc.). A more detailed description of these behaviors is given below in the method section (under instructions for observer identification). (4) Mutism occurred in about half of the children, who produced no recognizable words (their sounds consisted primarily of vowels). (5) Echolalic speech was present in the remaining children, who echoed the speech of others, either immediately or after a delay, giving the impression of non-related inappropriate speech (a more complete description of these behaviors is also given below in the instructions for observer identification). (6) In all children receptive speech was minimal or missing entirely. Some of the children would obey simple commands (such as "sit down," or "close the door"), but all failed to respond appropriately to more complex demands involving abstract terms such as prepositions, pronouns, and time. Most often they responded to speech in a very

generalized manner. For exaple, they would close the door to commands like "Close the door," as well as to commands like "Point to the door," or statements such as "There is a window and a door," etc. (7) There was also an absence of, or minimal presence of, social and self-help behaviors: most of the children could not dress themselves; most were unaware of common dangers (e.g., crossing the street in front of oncoming cars); most could not wash themselves or comb their hair; some were not toilet-trained, etc. (8) A minority of these children were self-destructive or self-mutilatory. All had severe aggressive, tantrumous outbursts, scratching and biting attending adults when forced to comply with even minimal rules for social conduct. Some smeared their feces.

Treatment. We will present a general outline of the treatment program here, and reference more detailed program descriptions when possible. In general terms, we have attempted to extinguish or suppress pathological behaviors, and to establish or teach socially desirable behaviors.

Because the children were replete with interfering self-stimulatory, self-destructive and/or tantrum behavior when they entered treatment, we attempted an immediate reduction of these. In our attempts to extinguish and suppress pathological behavior (including biting and scratching of self and others, feces smearing, etc.) we relied heavily on contingent: (a) reinforcement withdrawal, where the adult simply looked away from the child when he was in the tantrum, left the child in his room, or placed the child in an isolation room (separate from the treatment room0; (b) aversive stimuli, like a slap or painful electric shock; or (c) reinforcement of incompatible behavior, such as sitting quietly on a chair. The reason for suppressing self-stimulatory behavior lies in its apparent attenuation of the child's responsivity while he is engaged in self stimulation (Lovaas, Litrownik & Mann, 1971). That is, when the child is engaged in self-stimulation, it is difficult to teach him something else. The

reasons for suppressing self-destruction, feces smearing, etc., are perhaps obvious; and our intervention model does not prescribe the therapeutic benefits of their expression. Data and method for the suppressing of self-destruction have been given separately (Lovaas & Simmons, 1969).

Simultaneously with this first phase, the therapist attempted to establish a kind of primitive stimulus control. Usually, the therapist picked some simple behavior, such as the child looking at the therapist, or sitting down when the therapist asked. These behaviors could be easily prompted if the child did not already know how to respond. Usually, the therapist's attempts to establish stimulus control elicited the tantrumous and self-destructive behavior, so that these first two steps went hand in hand.

Once these introductory steps had been made, we began our teaching programs, where the language program alone consumed about 80 percent of the child's total training. The heavy emphasis on language training was partly for academic reasons. That is, we would like to know how far one can go in language training using operant procedures. It is not necessarily the most therapeutic step for all the children, since many of them may have benefited more from a program emphasizing nonverbal communication.

If the child was mute, we began a verbal imitation program (Lovaas, et al., 1966). If the child was echolalic (or once a mute child had about ten imitative words) we started a program to teach simple labelling, and as soon as possible, attempted to make speech functional. For example, as soon as a child knew a label for a food, he was not permitted to eat it unless he asked for it. The program gradually moved on to making the child increasingly proficient in language, including training in more abstract terms (such as pronouns, time, etc.); some grammar, such as the tenses; the use of language to please others, as in recall or story telling. These latter levels were never reached with the mute children,

but were usually obtained with the echolalics. A more detailed description of the language program exists on film (Lovaas, 1969) and in written outline (Lovaas, 1967).

At the same time we attempted to build speech, we also initiated programs designed to facilitate social and self-help skills. It included building those behaviors which made the child easier to live with, including friendly greetings and other shows of affection, dressing, good table manners, brushing his teeth, etc. We have published a procedure based on nonverbal imitation (Lovaas, et al., 1967) which has been particularly useful for these purposes.

Throughout, there was an emphasis on making the child look as normal as possible, by rewarding him for normal behavior and punishing him for being psychotic, teaching him to please his parents and us, to be grateful for what we would do for him, to be afraid of us when we were angry and pleased when we were happy. Adults were in control. In short, we attempted to teach these children what parents of the middle class western world attempt to teach theirs. There are, of course, many questions which one may have about these values, but faced with primitive psychotic children, these seem rather secure and comforting as initial goals.

We employed those reinforcers which were functional for a particular child. Many children would work only for food, and "settle down" only if given an occasional slap on the rear. For others, however, symbolic approval and disapproval were sufficiently strong reinforcers to maintain the child through the session. For some children physical punishment elicited too much interfering emotional behavior to be helpful. These decisions about effective reinforcers seemed easy to reach and did not require a great deal of special training in assessment. Their programming, however, was another matter, and required familiarity with shaping techniques. This raises the question about

the conditions for replicating the treatment, and we have made the observation that a highly skillful behavior modifier is hard to come by. Building "sitting behavior" or eye contact is easy compared to sorting out the discriminations required for verbal imitation in a mute, or prepositional speech in an echolalic. There are, however, reports of several programs (Hewett, 1965; Metz, 1965) and in particular the studies of Wolf, Risley, and Mees (1964), and Risley and Wolf (1967) which were developed reasonably independent of each other, yet present roughly the same methodology, and therefore demonstrate the feasibility of replication. However, the degree of expertness of the behavior modifier will dictate his results, and the field is so new that it is difficult to specify the exact conditions under which one produces such an expert.

Recordings. We have employed two kinds of measures of generalized therapy change. First, we have attempted to assess changes in the children's behavior using a multiple-response recording; and secondly, we have relied on changes in the children's Stanford-Binet and Vineland Social Maturity scores. The multiple-response recordings constitute the main focus of our measures and were designed to provide information on stimulus generalization, that is, the extent to which the behaviors we built would show up in a new unfamiliar environment. The other measures provide for much more generalized information both on stimulus and response generalization. We shall first present a description of, and data pertaining to, the multiple-response recordings.

Multiple-response recordings. We have published earlier (Lovaas, et al., 1965a) on an apparatus which allows for simultaneous recordings of several commonly occurring and everyday behaviors in free play/observation settings. Essentially, certain behaviors (both normal and pathological) are defined to an observer who records their frequency and duration on a button-panel, which in turn is coupled to a computer tape, allowing swift calculation of the frequency, duration, and

interaction of the various behaviors.

The kind of child one is studying helps decide what kinds of behaviors to record. In the case of severely psychotic children, this is somewhat simplified because of their limited behavioral repertoires. We eventually decided on five behavioral categories, whose presence or absence are used to describe autistic children, and which could also be reliably recorded. (1) Self-stimulation, which referred to stereotyped repetitive behavior that appeared only to provide the child with proprioceptive feedback (e.g., rocking, spinning, twirling, flapping, gazing, etc.). (2) Echolalic speech, which referred to the child's echoing the speech of others, either immediately or after a delay, giving the impression of non-related inappropriate speech, with pronoun reversal, incorrect use of tense, etc. We also included bizarre words and word combinations. (3) Appropriate speech, which was speech related to an appropriate context, understandable, and grammatically correct. (4) Social nonverbal behavior, which referred to appropriate nonverbal behavior which depended upon cues given by another person for its initiation or completion (e.g., responding to requests, imitating, etc.). (5) Appropriate play, which referred to the use of toys and objects in an appropriate, age-related manner. Two of these behaviors (self-stimulation and echolalia) are pathological. Their presence, and the relative absence of the remaining three "normal" behaviors, forms part of the behavioral complex diagnostic of autism. The instructions for recording, and hence rather complete definitions of these various behaviors, are given below.

> Instructions for rater identification. You will be watching for five kinds of behaviors. These will be the only behaviors you will have to record, so part of the time you may not be pressing a button at all. If you are uncertain about what is going on, you may also not be recording. The best rule is, if you can't make a decision, don't record anything. Each of the behaviors will be carefully defined and you will be given examples of what they are and what they are not. Each key on the panel is labeled with the name of one of the behaviors. Each time you notice the child engage in one of these behaviors, press down the corresponding key, and

hold it down until the child has terminated that behavior.

1. Self-stimulation. The best way to describe the various forms this kind of behavior may take is to begin with the head. The child may roll his eyes, cross them, look out of the extreme corners of them or squint them, contracting the muscles of the face all the way to the ears. He may stare intensely at lights, objects, or at parts of his own body (such as his hands). He may suck his tongue and lips or stick his tongue out repeatedly. He may put objects in his mouth. He may rock his whole head from side to side or allow it to fall forward, turning it slightly to the side with his eyes turned up or to the corners. He may cock his head and hold a particular position for long periods.

There are several typical forms of self-stimulation performed with the arms and shoulders. The child may move the arms up and down the sides of his body, flipping his hands from the wrist. He may flap his arms from the shoulder with his hands limp. He may hold his hands in very contorted positions, often staring at them intensely.

Using his whole torso, the child may assume rigid or contorted postures, or he may engage in body rocking. Rocking usually occurs in some sitting position and is a forward and back motion more often than side to side. He may twirl himself, rub, scratch, or tickle various parts of his body, or he may masturbate. He may jump repeatedly or run from wall to wall. He may walk on his toes.

In his interaction with physical objects, he may trace them, running his fingers along the edges, rub them, spin them, use them to make tapping noises or flip them back and forth. For example, he may spin a cup like a top, or he may hold a piece of string and rhythmically swing it to and fro.

All of these behaviors have the common appearance of producing sensory input for no other purpose than the stimulation itself. There is, however, a fine line between some of these behaviors and some of the more primitive forms of play. You will have to use your judgment to some extent to decide if the child is looking at something or staring at it, playing with it or tapping it. Often, you may be able to tell self-stimulation from appropriate play, by the fact that the child may begin to repeat a gesture or an act over and over again during self-stimulation.

Self-stimulatory behavior occurs to some extent in the repertoires of all children, and even to some extent in adults. You may find yourself recording something you feel looks like any child might do. Record it anyway. The difference is that you may see more of it than you might in a normal child.

These behaviors may or may not be accompanied by sounds or words the child may use. This makes no difference as the sounds or the speech will be treated separately.

2. Echolalic speech. Recording this behavior signifies that the child is using words in an unmeaningful or inappropriate manner. This type of behavior may present itself in one of several ways.

First, the child may appear to be repeating a word or several words to himself. The technical name for this type of speech is delayed echolalia. He may say things that sound like commands or statements he once heard, but which have nothing to do with his present activity, or the context in which he is operating. He may use phrases like some of the following: "hello John," "no, John," or "how are you, John." He may go to the door and say "you want to go out." Although this last statement does have relevance to the situation, such phrases will also be included when they sound like the imitation of what another person has said to the child at some other time. He may also simply repeat isolated words such as "balloon, balloon."

Secondly, the child may use bizarre speech, sounding like a word salad. The words may be understandable separately, but do not make any sense when used together. Examples are, "green rabbit," "Bufferin, one, two, three," or "happy puppy baby little." You may be able to think of it as sound input for the sake of the input, much like a verbal version of self-stimulation.

Finally, another class of behavior included in this category is immediate echolalia. For example, the adult may say "how are you, John?" and the child will answer "how are you, John?" The adult may say, "now it's time to draw," and the child will say, "draw."

Again, the key is depressed for the duration of the child's speech. You should not release the key after every word or phrase, but should release it if the child pauses or the adult speaks. You will not have to record "babbling." Also, do not record humming, grunting, squealing, or any sound which is unintelligible (including fussing or crying).

3. Appropriate speech. This behavior consists of intelligible, non-repetitive speech which is appropriate to the situation. If the child answers a question, makes a comment, labels an object, carries on a conversation, or reads aloud, you should record the behavior as appropriate speech. Depress the key when the child begins to speak, and release it when he finishes.

This category includes everything from the most primitive use of words, such as a simple "hi," or "go" (when the child is trying to leave), to the most complex conversation. The important element is that the child is using words correctly, meaningfully, and that he is readily understandable.

4. Social non-verbal behavior. There are two levels of this type of behavior. Level one describes certain kinds of interactions the child may display with the adult present. Included in this category are the simplest kinds of social relationships. Each party need only respond once. Thus, if the child makes a response, and the

adult responds by completing the interaction, this is one response. No further response is necessary. There are no chains of response. Examples consist of two types.

A. Demand behavior. The child grabs the adult's hand and tugs him toward the door.

B. Compliance. In this case, the child simply complies to some request from the adult. The adult may say, "sit down," "play ball," "put the block like this," and the child does. You should briefly depress the button (for less than one second) when the child responds appropriately to a request. Also included in this category is simple imitation when it is not part of a game. The adult may say, "jump, John," and then the adult may jump. If the child imitates the jumping, you should press the button.

All of these behaviors may or may not be accompanied by language. It makes no difference as long as the child is involved in some simple nonverbal response which depends upon the presence of the other person. Remember, the important element is that the child would not be making the response if the adult were not there.

In the higher level of social nonverbal behavior, the interaction demands a variety and flexibility of response from both people. There is a longer interchange, in which the people must make several different responses to complete the interaction. The game of "Simon Says" is a good example of this kind of interaction. The child must watch, listen, and mimic or not mimic the adult depending on what the adult does. Games of pretending, playing ball, imitating drawing, follow the leader, and tag are also examples. Each person must watch and respond correctly and complete the game. Again, two people must be present for this type of behavior to take place.

Because of the instructions given to the adult with the child, in almost all cases the child will have to initiate this kind of interaction (the major exception being ball play). Therefore, you may see a considerable amount of appropriate verbal behavior simultaneously taking place. Remember to keep the key depressed throughout the entire interaction.

5. Appropriate play. There are also two levels of appropriate play. The lower level is defined as exploration and simple play. It means that the child is exploring or manipulating objects and that he shows interest but inability to use them properly, or that he has a lack of experience in their use. He may be using them for play (rather than self-stimulation, for instance) but is not, perhaps, using them as they were intended.

He may be stacking tiles or blocks, scattering things, putting crayons in boxes, handling and examining various toys, pouring water into containers, etc. Here you must make the distinction between handling or examining and staring or using objects in a bizarre, repetitive, or stereotyped manner.

He may pile up objects, fit tiles in a peg board, punch a bobo, ring the telephone, scribble with the crayon, , pull the wagon, turn pages in a book, or make a rattle by placing small objects in a larger one. One common element here is that one response accomplishes as much as any series of responses to a given object. One response does not require another one, nor does it depend on a previous one. Stacking up one block does not require another be stacked to complete the stacking.

The higher level of appropriate play consists of the complex and appropriate use of objects, or participation in games in which there is a definite dependency of one response on another. One response leads to or proceeds from another in the accomplishment of some project. In this category, a number of responses completes some whole which no response individually could complete. Examples include making a pattern or picture with tiles or crayons, building an object with blocks, reading, pulling the wagon to transport objects for a project, setting bowling pins up in the appropriate pattern and knocking them over, and completing a puzzle. Each response here adds something new to the ultimate goal of some project. The games listed under social nonverbal behavior have this same quality, interdependency of response, and they should also be recorded (simultaneously). Note. There are several behaviors which may best be recorded by pressing and releasing a key immediately (a blip). This should be done in the case of social nonverbal behavior when the child obeys a command, or each time the child catches or throws a ball. It is not done each time the child stacks a block or fits a tile in appropriate play. Here you must use your own judgment. Do not record during pauses, but do not record a pause between every response. Are there any questions?

The reader may note that social nonverbal and appropriate play have been divided into two levels each in these instructions. This was done in an attempt to increase the discriminating power of these measures, and reflect a later development, not present in the recordings which we shall present in this paper.

In order to assess stimulus generalization, the children were observed in a room separate from, and not associated with, training, and in the company of an unfamiliar adult. The room was equipped, like most playrooms, with the following toys: a wagon, paper and crayons, a bobo doll, a nine-inch rubber ball, three plastic bowling pins, a plastic telephone, a magnetic board with numbers and letters which attach to it, 12 assorted wooden blocks, a six-inch

tom-tom drum, a hand puppet, and three simple wooden jigsaw puzzles. Observation sessions lasted 35 minutes and were divided into three conditions lasting 10, 10, and 15 minutes each. In the first condition (the Alone condition), the child was observed when he was by himself in the playroom. In the second condition (the Attending condition), an unfamiliar adult was present and attended visually to the child, but made no comment, interfered in no way, and did not initiate any interaction with the child. If, on the other hand, the child initiated some activity which required the involvement of the adult, the adult performed those responses and made whatever comments necessary to complete the interaction. In the final condition (the Inviting condition), the adult encouraged the child to participate in several different kinds of activities. The adult invited the child to play with each of the 11 toys in the playroom (one minute per toy), giving demonstrations of how to use the toy if the child appeared not to know how. The adult also attempted to initiate the simple game of 'patticake for one minute. He also gave the child a one-minute series of simple commands which could be performed nonverbally. This consisted of commands such as "stand on one foot," "touch the floor," and "sit down." The adult then asked a one-minute series of questions which could be answered either verbally or nonverbally. This series consisted of questions such as "where is your nose?" or "which block is bigger?" A final one-minute series of questions, which could only be answered verbally, was also asked. This series consisted of questions such as "how are you?" or "where do you live?"

The first four children (Ricky, Pam, Billy, and Chuck) who were given the multiple-response recordings received a "before" measure (in June, 1964) and were then measured on a monthly basis for the 14-month duration of their treatment. Pam and Ricky were discharged immediately to a local state hospital, while Billy and Chuck spent a short (less than six months) time with their families before

being hospitalized in the same state hospital. Pam and Rick were returned to us for follow-up measures two years later (1968). They were then briefly treated once more (24 hours for Ricky, and one month for Pam), discharged to the state hospital again, and finally returned for a second follow-up two years after that (1970). Pam and Rick received our treatment twice, in an ABABA (where A is no treatment, and B is treatment) design. Billy and Chuck were measured again four years after discharge from our project (1970); they received an ABA design.

We replicated essentials of the treatment on a second group of children (Jose, Michael, and Taylor) who were hospitalized in 1966 and received 12 months of treatment, with multiple response measures before treatment and at three-month intervals during treatment. They were returned for follow-up measures three years after treatment (in 1970): they received an ABA design.

The third group (Leslie, Tito, and Seth) to receive the multiple-response recordings were seen as outpatients. They were measured before treatment (1968) and after one year of treatment, and received follow-up measurements one year later (1970), in an ABA design.

A fourth group (Kevin F., Ann, and James) to receive multiple-response recordings was also seen as outpatients. They were measured before treatment (1969) and after one year of treatment (1970). However, since this group has just been discharged, follow-up data has not yet been attained.

The first and second groups of children, being inpatients, received eight hours of treatment per day six to seven days a week. The parents of the first group were not involved in the treatment. With the second group, however, we began to train the parents in our treatment procedures. The third and fourth groups were outpatients, and while we initiated training programs in the clinic, we otherwise served essentially as consultants (two to three hours a week) to the parents, training them in shaping procedures. The basis for changing the treatment procedure from treating

inpatients, with the parents as observers, to treating outpatients with the parents as therapists, becomes apparent from examination of the follow-up data.

We have multiple-response measures on only 13 of the 20 children we have treated. This is so because we initially had considered these measures to be inappropriate for outpatients since we had less control over their treatment. Since 1968, however, we have obtained multiple-response measures on the outpatients as well.

Intelligence and Social Maturity. The Stanford-Binet Intelligence Scale was administered before and after treatment either by an agency not associated with UCLA, or when this was not feasible, by a graduate student trainee in the UCLA Psychology Clinic. Eighteen of the 20 children received IQ testing. One child, Taylor, received the Merril-Palmer Intelligence Test instead of the Stanford-Binet. We will also present some data from the Vineland Social Maturity Scale, which was administered to the parents of the last 14 or the 20 children. The irregularities in the number of children who received the various tests does not reflect a systematic bias. Rather, in the early phases of the program we did not consider generalization and follow-up data to be significant data for our study, for reasons we presented in the introduction.

Results

Multiple response measures. Since the multiple response measures constitute the focus of this study, they will be presented first. The results will be presented as group averages, followed by discussions of changes in the individual groups and children. All the figures based on the multiple response measures have per cent occurrence of the behavior on the ordinate. This percentage was obtained by calculating the duration of a behavior, to the nearest second, and dividing it

by the duration of that condition (e.g., if S spent 200 seconds in self-stimulatory behavior during the 10 minute Alone condition, he would receive a measure of 33% self-stimulation at that time).

The first data, presented in Figure 1, give the before and after treatment scores for the various behaviors, averaged over all conditions for the first three groups. The various behaviors are presented on the

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Insert Figure 1 about here

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abcissa before (B) and after (A) treatment. Three groups are presented: T (total Ss); and the breakdown of that group into the children who were echolalic (E) and mute (M) before treatment. Looking first at the data from the total group, it is apparent that the "sick" behaviors decreased while the "healthy" behaviors increased. Specifically, self-stimulatory behavior was reduced to about one third of its pre-treatment level. Amount of echolalic speech remained unchanged when considered in the total group, but this is because the decrease in echolalic speech by the echolalic children was offset by the increase of echolalia in the mute children.

Turning to the healthy behaviors, the children showed about four times as much appropriate verbal and social non-verbal behavior after treatment, and almost three times as much appropriate play. There were no exceptions to these changes; all the children improved.

The total group consisted of five mute and five echolalic children. If we examine the data from the mute children we can observe that, in addition to not having speech, they showed more self-stimulation and less appropriate ocial behavior; in general, the mute children were "sicker" than the echolalic children. The figure makes it also appear that

the mute children show gains in treatment at least equal to the gains made by the echolalic children. While this may be a correct inference, it must be remembered that our measuring system gives equal weights to all behaviors within the various categories. For example, while the mute children showed increases in appropriate verbal behavior, the speech of the echolalic children seemed qualitatively superior to that of the mute children. More exact descriptions of the changes in speech are presented on film (Lovaas, 1968) and in a separate paper (Lovaas and Stevens, 1971). Perhaps it is sufficient to say that both mute and echolalic children improved with treatment, leaving out more specific comparisons. The data will now be discussed separately for each group.

Group 1 (Rick, Pam, Billy, and Chuck) was measured on a monthly basis, which enabled us to assess the rate at which the behavior changed. Their data are presented in Figure 2, where Pam and Rick (both echolalic) are presented on the left side. Billy and Chuck (mutes) are presented on the

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Insert Figure 2 about here

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right. The top part of the figure shows changes in verbal behavior, while the bottom part shows the nonverbal behaviors. For Rick and Pam, one can observe the gradual increase in appropriate speech. No trend is obvious for echolalic behavior. Billy and Chuck, who were initially mute, showed a rise in echolalic speech before it was replaced by appropriate language. None had appropriate speech before treatment; each had some appropriate speech afterwards. Inspection of changes in nonverbal behaviors show a decrease in psychotic self-stimulation, and increases in appropriate play and social

nonverbal behavior.

It is probably helpful to break the data down by conditions, since these reflect the degree to which the adult gained control over the child, and the extent to which the child initiated behavior independent of the adult's explicit direction. That is, the occurrence of social and language behavior in the Attending condition indicates spontaneous, "self-initiated" behavior. Figure 3 presents social nonverbal and verbal behavior separately for the Attending and Inviting conditions. Considering the behavior (top half of the figure), it is noteworthy that there was an absence of social nonverbal behavior in the Attending condition until about eight months of treatment. When it did appear, it reflected the children's spontaneous initiation of behavior, a very important sign of therapeutic progress.

Insert Figure 3 about here

The same spontaneous interaction was replicated in the case of appropriate verbal behavior (lower half of Figure 3), where the children began to initiate verbal contact with the attending adult after the eighth month of treatment. Reasonably, both social nonverbal behavior and verbal behavior were higher during the Inviting than the Attending condition; the attending adult exercised a facilitating effect on the children's social behavior by instigating it, being increasingly able to exercise control as treatment progressed. Also, the children show more social nonverbal than language behavior since the latter is more difficult to build.

There were, however, wide individual differences in the rate at which the children displayed these behaviors. Figure 4 shows the change in

appropriate verbal behavior over the Attending vs. the Inviting conditions for the first four children. Only Ricky and Billy engaged in spontaneous

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Insert Figure 4 about here

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verbal behavior with the attending adult. However, all the children learned to interact when the adult initiated the conversation, as can be seen in the Inviting condition.

Group 2 (Taylor, Mike, and Jose) was treated similarly to Group 1, with two exceptions: first, we employed no aversive stimulation (shock, spankings, etc.) for the first six months of treatment; and second, we initially held the children to a much less demanding schedule. By the latter, it is meant that we left a child at a certain level of mastery for a relatively long time before we introduced the next tasks. We also attempted some variation on imitation training by pairing food with the therapist's sounds instead of demanding the difficult discriminations we ordinarily would have. We did not observe any particularly encouraging improvement in the children's behavior after six months of such treatment, so we reverted to the more demanding treatment associated with the first group. Essentially, then, Group 2 received the same treatment as the first, but less intensively. These children also differed from those in Group 1 in that all three were mute.

The data on Group 2 are presented in Figure 5. The measures were

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Insert Figure 5 about here

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taken every three months, as presented on the abcissa. Results from Group 2 essentially replicate the results obtained from Group 1: the gradual replacement of "sick" by "healthy" behavior. We have not plotted changes in verbal behavior, since it was minimal, rising only to one or two per cent after 12 months.

Group 3 (Leslie, Tito and Seth) and 4 (Kevin F., Ann and James) were all outpatients, where we served more as consultants to the mothers, doing less direct therapeutic work with the children ourselves. James was initially mute, the others echolalic. The children were measured before and after one year of treatment. Data from Group 3 (Leslie, Tito and Seth) are shown on the left side of Figure 6, while the data from Group 4 are shown on the right side. The data from Groups 3 and 4 replicate the results from

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Insert Figure 6 about here

Groups 1 and 2: a decrease in psychotic behavior and an increase in normal behavior. Starting on the top of the figure, one can observe a rise in Appropriate Play, Social Nonverbal and Appropriate Verbal. Concurrently, there is a drop in Self-Stimulation and Echolalia.

While the measures on Group 4 (on the right side of Figure 6) did not reflect greater improvement than with the other groups (this is most clear in the case of Appropriate Play), it seemed clinically that the children in Group 4 showed a greater improvement during treatment than the other children. The failure of the multiple response measures to reflect this improvement may be based on the failure of those recordings to make discriminations beyond a certain level of behavioral complexity. We have previously

(Lovaas, et al., 1965) pointed out that some of the behavioral categories failed to discriminate beyond certain age levels for normal children. Therefore, for the last two groups of children we began to differentiate between different "levels" of social nonverbal and appropriate play (as was presented earlier in instructions for rater identification). We wanted the recording procedures to be sensitive to, for example, differences in play behavior which involved "simple" acts like repetitively dropping beads into a jar (level 1), as compared to imaginative doll play (level 2). With the data presented according to this new grouping, as we have in Table 1, then it is apparent that Group 4 has made most of its gain in the "higher" levels of these behaviors, while Group 3 made most of the gains in the "lower"

Insert Table 1 about here

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levels. If one plans to measure treatment effects on children who are more developed than the first three groups, then some attempts may have to be made at discriminating between "levels" of certain behaviors.

Follow-up measures. The first three groups (10 children) have now been seen for follow-up data on the multiple response measures. These measures have been taken anywhere from 1 to 4 years after termination of our treatment. The children can be divided into two groups, those who were discharged to a state hospital and those who remained with their parents. The overall data on the 10 children are presented in Figure 7. Per cent

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Insert Figure 7 about here

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occurrence of the various behaviors are plotted on the ordinate for before (B) and after (A) treatment, and shows the latest follow-up (F) measures. "I" refers to the average results for the four children who were institutionalized (discharged to a state hospital), and "P" refers to the six children who lived with their parents since their discharge from treatment. For all the five behaviors, the trends are the same: the children who were discharged to a state hospital lost what they had gained in treatment with us; they increased in their psychotic behavior (self-stimulation and echolalia); they appear to have lost all they gained of social nonverbal behavior, and they lost much of their gains in the area of appropriate verbal and appropriate play. The children who stayed with their parents, on the other hand, maintained their gains, or improved further.

Let us examine these children more individually, discussing the follow-up data of Rick and Pam first. When we terminated Rick and Pam's treatment we decided to recommend to their parents that their children be institutionalized. We based this decision on two major considerations. First, we had made the mistake of isolating the parents from their children's treatment such that they did not receive the training we did in handling their children. Secondly, these parents had other large commitments to their families or themselves. For example, Pam's mother had just given birth to a child with severe brain damage which required continuous care, and Pam was not an easy child to handle for anybody. Although Rick was continuing to make relatively rapid progress, Pam was merely "inching" along. Ricky's mother was divorced and needed full-time employment. There were other considerations to be made, involving the direction of effort on the research project. Provision for supervised foster home care, special

schools, etc., were judged beyond our resources. In most treatment projects one is confronted with this option, either to invest one's time and resources into the treatment of a few children, or to concern oneself with replicability and generality of one's procedures for many children. When one runs a research project one is fairly well restricted to the latter alternative.

Rick and Pam were discharged back to the state hospital they came from at the beginning of our treatment. It is difficult to specify the kind of environment a child enters when he becomes a patient in a large understaffed state hospital. In any case, they did not receive behavior therapy; behavior therapy was new at that time, and considered harmful by most psychiatric professionals. The emphasis in the state hospital was on "acceptance," which meant the children were encouraged to regress. We now know (Lovaas and Simmons, 1969) that traditional interventions may worsen some psychotic behaviors. During this time a foster home placement was attempted for Ricky, under the supervision of professionals with traditional orientations. Perhaps the turning point for the worse came for him when, after his school teacher reported that he was acting out in class, it was decided to remove him from school, instead of reprimanding him. As we shall show, it would have been easy to prevent his subsequent relapse.

The 1968 follow-up measures on Pam and Rick are given in Figure 8 (Follow-up

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Insert Figure 8 about here

1, 1968). The figure gives also the before (1964) and after (1965) measures. It is apparent that in 1968, two years after their first treatment, both children had lost much of their appropriate behaviors (speech, play, and social nonverbal are all down from 1965), and that much of their bizarre self-stimulatory behavior reappeared.

We decided to treat them a second time. The therapeutic effects of such an intervention would certainly provide a powerful demonstration of our therapeutic effects. It soon became apparent that the children had not forgotten what we had taught them, but that their problem was essentially motivational: they were not afraid to be "sick," neither did they behave appropriately in order to be

approved. The re-treatment consisted essentially of reinstating the contingencies they had experienced earlier, and lasted 24 hours for Ricky and 3 weeks for Pam. By examining the effects of the Treatment II, 1968 (Figure 8), it appears that this very short exposure to our treatment was effective: one can see a rise in the three appropriate behaviors (appropriate verbal, appropriate play, social nonverbal) and a drop in self-stimulation.

The children were institutionalized again and brought back for their last follow-up in 1970. As can be seen in Figure 8 (Follow-up II, 1970), they did again regress, as they had earlier. While appropriate verbal and social nonverbal behaviors seemed to have remained stationary, one can observe a loss in appropriate play, and a substantial increase in self-stimulation and echolalia.

Billy and Chuck were discharged to the same institution under conditions similar to those of Pam and Rick, their parents being essentially untrained and having serious other commitments and personal difficulties. Billy, like Ricky, was making relatively rapid progress at time of discharge and his institutionalization was viewed with much sadness. Chuck was similar to Pam, each new behavior had to be built with great care and effort. At the time of Chuck and Billy's follow-up four years later, they had retained much of their gains in appropriate play and social nonverbal behaviors but they lost much of their appropriate verbal behavior, increased echolalia, and showed a marked increase in self-stimulation.

Clinically, except for the increase in self-stimulation, in 1970 Chuck and Billy appeared identical to their discharge picture; they had learned nothing in the intervening four years. They gave the same smiles, the same looks, even the same words. It was astonishing. Billy had become

more thoroughly echolalic, "playing" with speech. Within the last year, Billy and Chuck have been placed in foster homes; Pamela and Rick remain institutionalized. In the intervening four years, Pamela had grown into a large, strong person, and become combative and very self-stimulatory. As with Billy and Chuck, all the behaviors she had learned in treatment with us were there; she had gained nothing new; she appeared to have stood still. Rick, in 1970, had regressed badly; he was depressed and listless, pacing like an old man, and giving increasing amounts of bizarre speech. He was refusing to eat and had lost much weight. While we felt we could have continued where we left off with Chuck and Billy, it is questionable whether we could recover Ricky a third time. Ricky's 1970 visit was very depressing, since he had shown so much progress with us (cf., the filmed record, Lovaas, 1968). This again emphasizes the point that without therapeutic prescribed contingent primary reinforcement, children like these don't improve or retain their improvement; and since we are not yet in a position to help them acquire normal, social reinforcers, their post-treatment environment has to be controlled. Ricky's and Pam's regression, when the treatment contingencies were removed, may reflect an underlying nervous system pathology. In our philosophy, however, functional contingencies are reality, and, if removed, any child would become a Ricky.

The follow-up data on Groups 2 and 3 are essentially covered by the Parent (P) group in Figure 7. The children were at home with their parents who had received some training in how to continue treatment with their children. Group 2 parents received less training than Group 3; Group 2 children were treated by us away from their parents, while Group 3 children lived with their parents throughout. The children were evaluated from two to four years after termina-

tion of treatment. The data on these six children are presented in Table 2.

Insert Table 2 about here

As a group, these data show that, unlike Group 1, Groups 2 and 3 did not regress, but retained their gains or continued to improve. The gains the children made in appropriate play, social nonverbal and appropriate verbal were usually retained. There was some increase in self-stimulatory behavior after treatment was ended. The data, however, point also to the large differences between the children; although we talk about them as autistic and psychotic, they are vastly different from each other. Clinically, Mike and Jose were doing better than Taylor at follow-up, both children showing particularly large amounts of appropriate play. Both Taylor and Mike were showing more self-stimulation, while Jose showed less. Jose is described more fully below. In general, the overall clinical impression of Group 2 at follow-up was disappointing. While the treatment for Group 1 seemed almost pointless, in view of their subsequent regression, our predictions for the second group are not much better. In both instances we failed to adequately protect or treat the post-treatment environment of these children. We now consider it a mistake to treat the child ourselves (e.g., by institutionalizing him), since this seemingly removes parental responsibility and opportunity to learn new ways to cope more effectively with their child. Group 2 were the last children to be treated in the hospital environment. In Groups 3 and 4 we did less of the treatment ourselves, and served more as consultants to the parents.

In group 3, Tito was doing best. He will be described in detail later. Seth was doing the worst. During the last year he evidenced extensive grand mal seizures and was on heavy medication, appearing somnolent and unteachable.

We have treated an additional 7 children for whom we do not have multiple response recordings. These children have shown behaviors at follow-up which

were similar to those we have presented here: The children who stayed at home improved; the two who were hospitalized regressed.

The reader may be aware of several potential sources of confounding in these data. Thus, the presence or absence of regression on follow-up may not seem to be a function of institutionalization vs. parent care, but one or more of the following variables: (1) The children who showed the least regression have been out for a shorter period of time. While this is correct, we know that if regression does occur, it will be evident within weeks or months.

Hence time since discharge (after the child has been out for a year) is probably not an important source of variance. (2) The later children were better off, at the beginning of treatment, than the earlier children. While this is true, there appear to be no systematic differences between the first three groups, yet the effect of parent vs. hospital care does show up here. Pam and Rick were better off than Chuck and Billy, yet all four children regress. However, when groups are not randomly assigned at the onset of treatment, one does open up for many sources of confounding. Additional replications are needed.

Intelligence and social maturity. We have obtained IQ scores on 18 of the 20 children. Figure 9 shows the changes in these measures during the time

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Insert Figure 9 about here

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the children were in treatment. IQ scores are plotted on the ordinate for before (B) and after (A) tests. The dotted lines indicate that the patient was untestable. Most of the children showed substantial changes with treatment, functioning in the mildly to moderately retarded level by the termination of treatment, while they were previously untestable. This means that before treatment the children would not respond to the examiner's attempts to test them. For example, they would not sit in a chair if asked to do so; and they remained oblivious to the testing materials which were presented to them. After treatment, the children would cooperate; that is, they would respond to the examiner and engage in the behaviors he wanted (such as block building, etc.). Some of this change reflects extinction of interfering behaviors, while some reflects genuinely new acquisitions. It is an open question whether these changed IQ scores would be predictive of the childrens' future performances in school.

We obtained the Vineland social quotients for the last 14 children we treated, and all of the children showed large gains. The mean social

quotient before treatment was 48, with a standard deviation of 20; the mean quotient after treatment was 71, with a standard deviation of 27. The changes which took place in social maturity are consistent with the IQ data in that the children showed large gains in their ability to look after their own practical needs. Much of this change was again due to a reduction in bizarre behavior, and the achievement of elementary social stimulus control. As with the other measures, there were no exceptions to the improvement; all 14 of the children had higher quotients after treatment than they did before treatment. We did not obtain follow-up data on these measures.

Reliability

We attempted to solve the problems associated with reliability of the multiple response recordings in two ways. First, we maintained, for the majority of recordings, at least two trained Os who were randomly assigned to do the recordings. These Os changed over time, such that the Os who scored for the second half of a year were often different from those who scored the first half; therefore, they had different degrees of familiarity with the children. These steps, of rotating Os and bringing in new ones, helped to reduce observer bias in the recordings. Each new O received about three to six one-hour training sessions. Here, the various behaviors were defined for him; he became familiar with the apparatus; and he worked with an experienced O until the average difference between the Os' scores over all behaviors was less than 20%. This was calculated by dividing the difference between given pairs of scored by the average of the two scores, and then averaging these percentages for all behaviors. The reliability between Os was checked on a monthly basis, and if they exceeded the 20%

given above, they were retrained. In Table 3 we have presented randomly drawn pairs of Os' recordings from the first group of children. There is

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Insert Table 3 about here

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a high agreement between Os. The table also shows that during the first year we recorded physical contact, tantrums, and vocalizations, which we deleted in subsequent recordings. Physical contact and vocalization were deleted because they are not directly related to the child's chances for success in "normal" society. Tantrums were deleted because they were a low rate behavior which changed very quickly; therefore, no change over time was apparent in our measures.

The high degree of agreement between Os, and their random assignment across observations, helps to insure that the data can be replicated, and that they are not the product of a particular O. However, Os' familiarity with the study, and knowledge that the children were in treatment may have contributed to the ratings of improvement. This seems unlikely when one considers the explicitness with which the behaviors were defined, and the often subtle changes in the data which would be difficult to "fake" and hence appear to validate the children's improvement. Nevertheless, the study is greatly strengthened by the following investigation which demonstrates that naive Os, scoring the sessions in a random order, give data similar to that of our experienced Os.

Three Os, who were unfamiliar with the children and the purpose of the study, were introduced to the recording system and presented with video recordings (Sony EV 200 1-inch) of the children displayed on an 8-inch

television monitor. The first tape they saw was the pre-treatment tape of a seven-year-old echolalic autistic child who evidenced all of the behaviors the Os were supposed to record. Os were given a total of nine one-hour training sessions. In the first three sessions, Os viewed the tape to familiarize themselves with the behaviors to be scored, learned the position of the keys on the board, etc. These three informal sessions were followed by six sessions where O's scores were computed and fed back to him as high or low in relation to the mean score for a particular behavior over the three Os. The tape was then replayed to all Os, and the instances where they had disagreed were discussed. This kind of training was like that given to the Os who scored the children *in vivo*. The recordings were different in that the Os were required to divide social nonverbal and appropriate play each into two levels (see the Instructions for Observer Identification), which with eye to face and self-stimulation, gave eight behaviors. Since this is more than an O can record at one time, particularly from tape, the tape was replayed twice to break up the recordings into two sets of four behaviors.

The data showing the acquisition of agreement between these three Os over the last six sessions are given in Figure 10. In all cases, a mean

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Insert Figure 10 about here

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figure for the three Os for any one behavior during a given condition was obtained. Percent deviation was averaged over all conditions and behaviors for a given O for each session. O1, then, shows an average percent deviation of 35% during the first session. The figure shows that Os eventually

learned agreement.

After the completion of this reliability training, one of the Os (O7 in Figure 9) scored the pre- and post-treatment tapes on three children (Michael, Ricky, and Jose) to assess whether a naive O could record the treatment effects in agreement with our experienced Os. She scored the tapes in the following order: Mike's pre-treatment, Mike's post-treatment, Jose's post-treatment, Ricky's post-treatment, Ricky's pre-treatment, and Jose's pre-treatment. All tapes were scored in order of condition Alone, Attending, and Inviting except Mike's, where the conditions were scored in order of Attending, Inviting, and Alone.

This is a direct test of the reliability of our scoring procedures, as it removes potential effects for both Os' familiarity with the experiment, and the order in which they recorded the behaviors. Table 4 presents the comparisons between the scores obtained by an experienced O recording the child *in vivo*, and a naive O scoring off the tape of that same session.

Insert Table 4 about here

The absolute values between the two Os are different, probably because the video recording reduces fidelity (i.e., there is particularly less fidelity with speech and facial expression). However, the naive O recorded improvements in normal behavior, and reductions in pathological behaviors, similar to the changes recorded by the experienced O. The only exception to this regards Ricky's self-stimulation, which shows an increase in the "after" measures when scored off the tape. Os suggested that this may have been due to the large amount of Ricky's facial contortions, which were detected

and scored as self-stimulation in the in vivo pre-treatment condition, but which could not be detected on the tape.

To summarize our findings concerning the reliability of our recordings: (1) there was a high degree of agreement for pairs of experienced Os who were randomly assigned to do in vivo recordings; (2) naive Os, unfamiliar with the study and children, could also be trained to show high agreement in their scoring of video recordings of the children's behavior; and (3) the direction of the behavioral change in treatment was scored essentially the same for a naive O scoring pre- and post-treatment video tapes in a random order as it was for experienced Os scoring the sessions in vivo.

Discussion

In summary, the main results of this study have been that: (1) "sick" behaviors (self-stimulation and echolalia) decreased during treatment, and "healthy" behaviors (appropriate speech, appropriate play, and social non-verbal behaviors) increased; (2) spontaneous social interactions and the spontaneous use of language occurred about eight months into treatment for some of the children; (3) IQs and social quotients showed large gains during treatment; (4) there were no exceptions to the improvement, but some of the children improved more than others; (5) follow-up measures taken two years after treatment showed large differences depending on the post-treatment environment (children whose parents were trained to carry out behavior therapy continued to improve, while children who were institutionalized deteriorated); (6) a brief reinstatement of behavior therapy could temporarily re-establish the original therapeutic gains in the institututionalized children; and (7) a reliable technique for recording therapeutic change was

developed, where Os were trained to be able to recognize and record specific behaviors which, by their presence or absence, are diagnostic of autism.

Individual differences

While these findings characterize each of the children in the group, there has been considerable heterogeneity with respect to the degree of improvement shown by each child. The delineation of "autism" is one area which will demand considerably more work. It has not been a particularly useful diagnosis. Few people agree on when to apply it. It is not a functional term in the sense that it is neither related to a particular etiology nor to a particular treatment outcome. Our children responded in vastly different ways to the treatment; Ricky learned, in one hour, what Jose learned in one year. Several of the mute children, once they had acquired some socially appropriate behavior, were reclassified as retarded. Perhaps retardation would have been a more appropriate diagnosis for them initially. Many of the autistic children showed an acquisition rate, of even simple discriminations, which was much slower than that we observe among the severely retarded. The major areas of improvement were not the same for each child. We asked the parents of each patient if they noticed any areas in which their child had improved or regressed more than others. Except that all of the parents reported gains in language and general attentiveness, there was no systematic pattern with respect to areas of major improvement. None of the parents reported any areas in which they felt their child had regressed. Since there was such heterogeneity among the patients, three fairly representative case descriptions will be presented in order to give a picture of the clinical implications of our findings:

first, of Scottie, who showed considerable gains in treatment; second, of Tito, who showed moderate gains; and finally, of Jose, whose progress was minimal.

Scottie, who was four and one-half years of age at the start of treatment, spent much of his time staring into space, did not attempt to interact with people unless he was directly addressed, when he would show a passive and friendly interest. When left to himself, he would self-stimulate; he was particularly attracted by spinning wheels. He was echolalic, and he could label common objects, but he had very little communicative, and no spontaneous speech. He had to be washed and dressed by others, helped when he ate his meals, and he was not fully toilet trained. He was, however, relatively free from tantrums, and he could understand simple directions. Because of his social responsiveness when approached, and occasional appropriate play, he was considered to be better off than most of the children we have seen. His social quotient was 68.

The initial sessions were run in his home, lasting two to four hours each, several days a week. His treatment consisted of programs set up to teach him communicative skills, as well as skills necessary for him to be able to look after his own practical needs, and to take a more active part in his everyday life. He was taught the usual abstract terms, such as prepositions, the concepts of time, counting, number, singular vs. plural, etc. He was taught not to echo. Meals and almost all daily activities were made strictly contingent on his verbalized requests for them. In the beginning, he missed several meals. He was also taught the concept of offering materials as well as requesting them. Much emphasis was placed on conversational speech, where he was asked a general question about something

he had done, and then asked progressively more specific questions. Any spontaneous responses he made were reinforced socially, since he was responsive to social reinforcers. We focused our treatment on consultations to his grandmother, who was brought in to take special care of him, and who held him to a highly demanding schedule; she did not tolerate his withdrawal or other expressions of pathology.

Scottie is presently attending third grade in a normal elementary school. His social quotient is 100. He shows no trace of autism, and in all aspects must be considered a normal child.

Tito, at admission, was a hyperactive five-year-old boy who evidenced an extremely short attention span. Eye contact was absent. He had many compulsive rituals. For example, he would spend considerable time lining up objects in a straight line and would become very upset when these were disordered. He "refused" to let his parents read the Sunday paper since he became very upset when they removed the string that tied it in a bundle. He was untestable on intelligence tests, and he obtained a social quotient of 52. He was echolalic, but occasionally would use speech for communication. His understanding of speech, however, was minimal. He resisted any involvement with people, and was unresponsive to shows of affection. He was extremely negativistic and clever in getting himself out of situations he did not want to be in, countering even the most elementary demands (e.g., "sit in the chair") with extreme tantrums.

Tito was treated as an outpatient on a three-session per week basis for one year, where we also served as a consultant to his mother, who was very conscientious and loving to him. His treatment program consisted of two main objectives. First, we tried to help him learn to deal with

frustrating situations by reacting to them more maturely and not with tantrums. This was an extremely demanding job, and he received many spankings. Secondly, he was taught those basic skills upon which he could build more complex abilities, particularly in language. Included in this category were pronouns, prepositions, number concepts, actions, relative concepts such as big and little, and social greetings. He was taught to comment upon his environment. He was also taught to draw, and to play more appropriately.

At discharge, Tito was quite observant and alert, but showed definite signs of being educationally handicapped. He had made some progress in most areas, but showed his biggest gains in the language area. His speech was quite spontaneous, and he could comment correctly on most social interactions. He obtained an IQ of 47 and a social quotient of 63. He currently attends a school for retarded children three hours per day. His mother reports that he has continued to show improvement in most areas. He is emotionally aloof to strangers, but close to his mother. His future is uncertain. He may escape instutitionalization if his progress continues.

Jose was four years old at the start of treatment. His extreme negativism was reflected in tantrums, biting, and extreme stubbornness. He did not play with peers. He did not respond to his name or any commands. He had no speech, could not dress himself, was not toilet-trained, nor did he have any other self-help behaviors. Appropriate play was essentially absent. He was found to be untestable on intelligence tests. He had a social quotient of 59. In short, he was extremely regressed.

He was treated as an inpatient at the UCLA Neuropsychiatric Institute for one year. His mother was given some training in how to continue therapy

with him. His treatment was primarily designed to overcome his negativism and to build some basic language skills. The latter included simple labeling, color discrimination, response to simple commands, form discriminations, and some work on the reinforcement of spontaneous babbling.

We probably made slower progress with Jose than with any of the other children. At discharge, his gains in language were minimal: he would obey some commands; his vocabulary included a number of common nouns, some names, and a few verbs. He could use these words to lable or express a desire for something, but never for commenting. He would attempt to imitate new words spontaneously on occasion. The greatest improvements were social. His social quotient of 74 reflected increases in smiling, laughing, and self-help skills. He was partially toilet-trained. He was testable on the Stanford Binet Intelligence Scale (IQ = 47).

At present, Jose spontaneously uses only a few words (e.g., "car," "go to school," etc.), and what he has retained of his speech training is negligent. He can take care of himself at dinner, and is fully toilet-trained. He made his major gain in play, which has become elaborate and creative, enabling him to entertain himself. He appears indifferent to people. While at intake he appeared unaware of ("blind" and "deaf" to) social contact, he now appears as if he does not care whether anyone is there or not. He has to be watched because otherwise he runs away from home, going nowhere in particular, but may be killed by dangers he is not aware of. His parents plan to place him in a nearby state hospital, where he will be able to come home on weekends and short vacations. We concur in these plans.

Relationship to other studies Rutter (1966) has provided a compre-

hensive review of follow-up investigations dealing with sizeable groups of children diagnosed as autistic. The results of the studies which Rutter reviews have been surprisingly consistent and may be summarized as follows. (1) About half of the patients studied were in institutions at follow-up. (2) Over two-thirds of the children had poor outcomes on social measures. (3) About half of the children remained mute or were without useful speech. (4) In almost all cases, there were declines in IQ. (5) There were large differences in outcome for various subgroups of autistic children, such that of those children who originally had IQ scores below 50, almost none acquired speech nor received any schooling, and three-fourths were in long-term hospitals at follow-up. In general, IQ has been the best prognostic indicator. Some studies have shown that if the child was mute and had no appropriate play before the age of five, the prognosis was particularly bad. (6) When marked improvement has taken place, it has generally become evident before the age of six or seven years. From middle childhood on, the course has been fairly regular, with a continuation of improvement or deterioration evident by then.

While there has been a paucity of research relating therapy to outcome for autistic children, the findings that have been reported generally show outcome to be unrelated to whether or not a child has received therapy. When improvement has taken place, it has been described as "spontaneous," that is, independent of a professional prescribed treatment. Of those children who have shown marked improvement, most still showed a striking lack of social perceptiveness at follow-up. Rutter has also noted that the loss of the diagnosis of autism was not necessarily associated with improvement in other areas. Specifically, a general lack of "social know-how"

or empathy remained, and there was generally no improvement in IQ. Havelkova (1968) has reviewed several other recent studies. The results have been consistent with those reviewed above. It is important to note that given the considerable heterogeneity among patients diagnosed as autistic, it is not enough to merely say that one has treated autistic children. Considering that some children improve without treatment, and that these children are differentiated from those who don't by certain behaviors, a good diagnostician can select his patients in such a manner as to end up with a majority of children who eventually improve independent of the treatment offered. No doubt such preselection of patients, which allows the therapist to count upon a much more favorable base rate change than is true of a nonselected group, keeps many nonfunctional treatments alive.

We utilized several procedures which place some confidnece in our inference that autistic children improve with behavior therapy. First, we have performed two within-subject replications (on Rick and Pam), and in both instances demonstrated that we could manipulate our treatment control at will over the course of time for these patients. Thus, their behavior change must have been due to our intervention. Secondly, we performed several betwee-subject replications, and all of the children responded similarly to the treatment. Also, each group of children was treated independently of the others, demonstrating that we could replicate our treatment effects independent of any conditions which may have been specific to one group of patients. In order to further control for bias in the selection of patients, we selected the majority of our patients according to those specific symptoms (IQ less than 50, mutism or no appropriate play) which were considered to be poor prognostic indicators. Neither did we

drop any patient from treatment once we began. Finally, we consider our measures to be socially meaningful, and independent of any given theory of autism; that is, they are directly related to the child's everyday behaviors.

Further evidence which directly supports our results has been provided by other behavior therapy programs which also demonstrated improvement (Hewett, 1965; Risley & Wolf, 1967; and Wolf, Risley & Mees, 1964). Furthermore, Wolf et al. (1967) have provided some additional data which lend support to our follow-up results. Such data demonstrate the feasibility of replication of behavior therapy with autistic children.

Major Strengths. Behavior therapy with autistic children helps. That is its major asset. So far as we know, despite its limitations, it is the only intervention which is effective. It did not give everything to every child. Sometimes it gave very little to a particular child, but it did give something to each child we saw. The improvement was analogous to making from 10 to 20 steps on a 100-step ladder. Scotty probably started at 80 and gained 20; his treatment brought dramatic changes, he became normal, and his change is irreversible. Jose, on the other hand, may have started at 10 and gained 10; the change was not all that dramatic.

We have been especially good at suppressing self-destruction of children who have mutilated themselves for years. The suppression was highly discriminated (situation specific), but this merely meant that we had to apply the treatment in more than one environment.

We have been quite good at rearranging behavior. For example, if the child was not mute (if he already had psychotic speech), then we could help him make large strides in his language and intellectual behavior.

The treatment generalized. Our multiple-response measures clearly demonstrate that we obtained stimulus generalization. We know that sometimes

the generalization was not as broad as we would have liked. The shift in our program to teach the parents to treat their own children is a direct attempt to build greater stimulus generalization.

We were interested in response generalization as well as stimulus generalization. We do have some data on the subject, but it is limited. Response generalization, like stimulus generalization, deals with efficiency; how much behavior can one get for free? We got changes on the IQ tests for free; we did not train the children on the test items, yet they improved. We have limited data on response generalization because psychology has little to say about it. We did not know what kind of changes to expect, which made it difficult to assess changes this first time around. From casual observation, during the treatment, the children looked much more "alert" and "aware" and became affectively much more prosocial. It was particularly dramatic when, during the continuous demands of the therapy hour, the child would suddenly start sobbing and put his head in the therapist's lap; or when, after much hard work, he became delighted over his new mastery. One does not observe "autistic" children showing much appropriate affect very often.

Other changes were difficult to assess because they seemed outside our behavioral framework. The children who were chronic toe-walkers (one of the soft neurological signs) began to walk normally after four to five months of treatment. Children who had never slept normally through the night put in 10 hours of uninterrupted sleep. Children who were chronically diarrhetic changed to having firm stools, etc. It is the search for this kind of generalized behavioral change which we feel will be

particularly useful in future research.

Major Weaknesses. There were many disappointments, and only a full appreciation of these will enable more realistic hopes now, and solutions in the future. We will discuss the major problems.

The most significant disappointment was the failure to isolate a "pivotal" response, or, as some might describe it, the failure to effect changes in certain key intervening variables. By that we mean that we searched for one behavior which, when altered, would produce a profound "personality" change. We could not find it. We had once hoped, for example, that when a child was taught his name ("My name is Ricky") that his awareness of himself (or some such thing) would emerge. It did not. Similarly, the child who learned to visually fixate on his therapist's face did not suddenly discover people. Our treatment was not a cure for autism. We felt we had to start somewhere: the child who learned his name was then in a position to learn someone else's name; if he could visually fixate on his therapist's face, he could pay more attention to teaching cues.

The failure to isolate a pivotal response (or change a crucial intervening variable, or cure autism) can be seen from two different viewpoints. First, behavior therapy may not be the correct approach to this problem. One could suggest in this regard that the "underlying pathology" (the intervening variable) is biochemical, and that the early detection and correction of this imbalance will enable the child to learn from his everyday environment, with little or no special educational remediation. If this should prove to be the case, our research has

limited ultimate clinical value for autistic children; behavior therapy alleviates some problems now, but the ultimate solution may involve correction of a biochemical imbalance. This is a viable alternative, and intelligent people will pursue it.

Speaking of physiological variables, it is possible, of course, that the pathology is structural. It could be that something is missing, as is the case with the blind or deaf child. The repair of this structural deficit, an attempt to "connect up" millions of neurons in order to replace or bypass the deficit, is beyond the limits of present technology. We must then approach the problem as we approach blindness, or deafness. In other words, it is possible for the underlying pathology to be neurophysiological, yet its treatment may require an essentially psychological-environmental intervention (like behavior therapy). It is the early detection of blindness and deafness, and subsequent special remedial environments, which allow blind and deaf children to develop normally. Without special consideration, they would probably closely resemble the autistic children. The perceptual deficit which may underlie autism is more difficult to assess, hence it is more difficult to remediate. We will speculate on some possible basis for such a perceptual deficiency later in this paper.

The other possibility is that behavior therapy is the correct approach, and that it is the problem which is erroneously conceptualized. A full discussion of this point involves evaluations of terms like "mental illness," "treatment," etc., and that is beyond the scope of this paper. But it is important to bear in mind that "autism" is an inference, and a very shakey one at that. We have been expected, in a sense, to cure the children

of someone else's inferences about them. There are no studies on "autism" which point to either a common etiology or a common response to treatment (or even a common response to an experimental situation of much more limited scope). "Autism" was coined prior to a functional analysis of pathology. The public and emotional appeal associated with the term, not our scientific understanding of the "syndrome," helps the term survive.

There are other conceptual problems. Consider, for example, an easy

behavior to build, "looking at the therapist's face." In the data language this behavior has a very limited meaning. However, the associated theoretical structure is very extensive, denoting a child who is recognizing and evaluating another person. For autistic children, the behavior of looking or not looking at another person has acquired very special significance on a purely conceptual level. According to some conceptions of the problem, one would expect major changes in the autistic child who started to look at others. In our research we have found these changes to be minor, not major.

Similar conceptual problems are extensively illustrated in our language program (Lovaas and Stevens, 1971). In this paper we point out that despite the fact that many of the children acquired use of very elaborate language patterns, involving pronouns, tense, etc., we observed no major concurrent personality reorganization. His language acquisition helped him postpone gratifications, express his wants, and in general served as a vehicle for improved interpersonal interactions. We do not understand the conditions under which language acquires meaning very well. Perhaps Skinner (1957) is correct about language when he argues that in order for an event to become private, it first must be public. Certainly these children gave no indication of possessing much of a public language prior to treatment. Any private meaning or property which speech possessed for them must have been derived from their treatment environment.

The observation that children who were treated by their parents did better than those who were institutionalized, while it solves some problems, opens up new ones. Not all parents are equally good as behavior modifiers. The more successful parents seem to have the following features:

(1) A willingness to use strong consequences, such as food and spankings, to become very angry, as well as very loving. Not all parents can do this; some people are more "gentle" or permissive than others, preferring to

let their children "grow" or "develop" while they, as parents, assume more of a spectator role. Others obsess a lot on the subtle "meanings" of their child's behavior. It is our opinion that such parents do not do well with their autistic children.

(2) To deny that their children are "ill". To deny the child the "need" to be sick, and to give him some responsibility.

(3)To commit a major part of their lives to their children, and to exercise some degree of contingent management throughout the day. This virtually rules out any professional or extensive social interests on the mother's part, requires a stable family structure, etc. Parent assistants, such as special tutors, can help out at times, but in the long haul, it is the parents who count.

It is helpful to illustrate the importance of the parent's motivation in yet another way. One of the children's most striking improvements centered on their increased manageability. Autistic children typically show severe tantrums and destructive behaviors. The behaviors occur in various strengths, and often the child has become his family's tyrant. It is sometimes difficult to find a parallel to the child's brutality. To illustrate, the child may have kept himself and his mother awake most of the night, and has done so since he was born. He begins the day by emptying the flour and sugar containers on the kitchen floor, smearing feces on the bathroom walls, ripping what is left of the curtains off the livingroom windows, moving then into the baby sister's bedroom, upending her bed and spilling her on the floor, only to bite his mother if she tries to restrain him. Such homes look like Gustapo headquarters, the child is cruel, the "home" is barren. These mothers do not invite friends over for dinner; they do not have flowers in vaces or pictures on the wall. They are prisoners of their children, who with professional help (the talk about the child's "need for love", "understanding his illness")

have played on the parent's guilt and reduced them to incompetence.

It is very easy to eliminate such tantrums and destructive behavior through the suppression procedures described earlier. We recorded these changes on the multiple-response recordings, but we did not graph them since the change is uneventful, i.e., the behavior dropped out immediately and stayed down. The parents reported a similar change at home. Such a sudden change is analogous to those we have seen for self-destruction, probably because these behaviors fall within the same response class.

A child who becomes manageable does not simultaneously become normal, but he does now allow for teaching to begin. The disruptive nature of these children's behavior is a major deterrent to the child's acceptance into a public school, yet it is the easiest and quickest behavior to ameliorate. It is our experience that most parents, having been brought up on the "mental health philosophy," have to discard their philosophy in order to become effective teachers.

Research Problems. We had anticipated that the children in the State institutions would regress. From the beginning, we have published studies (Lovaas, 1967; Wolf, et al, 1964) which show that when the experimental reinforcers were withdrawn, behaviors weakened. Such extinction occurred whether we employed food or fear as reinforcers, and whether the behavior was physical contact, imitation or abstract speech. The shift from response to time-contingent delivery, the very procedure which we employ to demonstrate the effectiveness of our main treatment variable, also demonstrates our major weakness, the tenuousness with which the behavioral gains are maintained. Reversible baselines help one's research design, not one's patients.

The reversibility of the treatment effects is not peculiar to autistic children, but has been observed in a large variety of behavior therapy programs, and has led Bandura (1969) to speak of the distinction between physical and psychological treatments. He points out the differences between the induction, generalization and maintenance of behavior, because these processes are governed by somewhat different variables. Tharp and Wetzel (1969) attempt to avoid discrimination and reversal problems by placing the treatment in the hands of those persons who have control over most of the patient's reinforcers. Our failure to maintain the gains with the first four patients underscores the need for that kind of intervention. Wahler's (1969) study provides a good illustration of the need for interventions across settings. When his children were treated in school, they did not necessarily change at home. When the contingencies were instated both in the home and at school, the behavior changed both places. Many therapists (cf. Patterson and Bechtel, 1970) have now turned to the child's parents as the essential mediator of treatment.

The extent of the reversibility of treatment effects will probably be some function of various patient characteristics. It seems that when the primary problem centers on the patient's poor motivation, and when treatment relies on "artificial" or experimental reinforcers (stimuli which do not characteristically maintain the patient's behavior on the outside), then one invites certain problems. Food, slaps, and accentuated social reinforcement are not the reinforcers which maintain the daily behaviors of normal school-aged children. Our use of such reinforcers set up the exact conditions for the kind of discriminations and the kind of extinctions we did not want. The children's reliance on primary reinforcers, rather than the everyday, more natural ones, is a probable

reason why the children regressed in the state hospital environment. The state hospital, since it did not prescribe contingent primary reinforcement, constituted an extinction run.

It is implied in the above discussion that we view the problem of maintaining the treatment gains (generalization over time) as a special case of stimulus generalization. When the child stayed home with his parents who had learned our techniques he did not regress (i.e., extinguish) because the environments before and after discharge were similar (i.e., we maintained stimulus generalization). However, the child who was discharged to a State hospital entered a new environment to the extent that it did not possess (or did not program) effective reinforcers. Remember that the children had not "lost" the behaviors we had given them (some "progressive disease" had not rotted their brains), they simply did not perform, they were unmotivated, unless we re-exposed them to the treatment contingencies. Perhaps this is the reason why follow-up studies as such are not very interesting to a behavior modifyer, but discrimination learning is. The point is that it is important for research in behavior therapy to be directed towards ways of normalizing reinforcing functions so as to smooth the transition (prevent a discrimination) between the treatment and post-treatment environments.

The second major research problem centers on how to develop procedures for speeding up the acquisition of new behaviors. No doubt, the slow rate with which some behaviors were acquired was based on the children's inadequate motivation, which we have discussed above. However, it also seems to be the case that autistic children show deviations in attentional behaviors and that these deviations slow down their acquisition, particularly of that kind of learning that requires shifts in stimulus control. Autistic children appear to respond in an overselective manner to multiple cues. We referred to this problem as stimulus overselectivity (Lovaas, et al.,

1971). This finding has led us to consider redesigning many of our teaching procedures. For instance, we may well have to minimize our use of supporting prompts and prompt fading techniques as these may provide interfering rather than helping stimuli in the learning process of these children.

Perhaps it is this stimulus overselectivity which prevents, or slows down, the autistic child's acquisition of secondary reinforcers as well. Given our consistent use of primary reinforcers, the associated environment would probably have acquired a larger range of reinforcing function for the normal child. If secondary reinforcers are acquired classically (through the simultaneous presentation of neutral with already functional stimuli) then the autistic child, being overselective, may fail to respond to one of these inputs, hence fail to condition. In the process of shaping behaviors in the normal child, then, the therapist may not have to address himself specifically to building reinforcing function. To insure long lasting effects in the autistic child, the process of building secondary reinforcers would seem to require much more effort.

It is important to remember that behavior therapy is a treatment which is based on research rather than deduced from theory. It is a technology for producing behavioral change through environmental manipulations. For this reason, it is constantly changing. Five years ago imitation training procedures were developed. Our treatment changed, and its effectiveness was greatly increased. Similar gains occurred when we developed procedures for building abstract speech. Just a short time ago, many argued that autistic children were unable to imitate, and that they were unable to form abstractions.

Change does occur. However, the philosophy of this approach leads one to expect gradual, rather than sudden, change. Treating regressed psychotic children with behavior therapy is like building a person. We do not know all the functional relationships which would enable us to complete the job of designing a person at this time. But, we have taken the first few steps, and it is important to continue. To work with autistic children gives one a rare opportunity to build from the beginning.

In closing, we should note that many of the procedures we have described are not new, but bear striking similarities to those described by Itard ("The Wild Boy of Aveyron"), by Sullivan ("The Mircle Worker") and recently by Clark ("The Siege"). Note the similarity in their willingness to use functional consequences for the child's behaviors, the meticulous building of new behaviors in a piece by piece fashion, the intrusion of the education into all aspects of the child's life, the comprehensive, hour by hour, day by day commitment to the child by an adult, etc.

So the principles we employ are not new. Reinforcement, like gravity, is everywhere, and has been around for a long time. The principles can be used to the child's advantage, or they can be turned against him. What is new in behavior therapy is the <u>systematic evaluation</u> of how these principles affect the child. It is not the content of behavior therapy which is new, but its research methodology. In that sense, we have an immense and often unappreciated advantage over those who preceded us, the methodology enables us to contribute in a <u>cumulative</u> manner to psychological treatment.

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TABLE 3

BEFORE AND AFTER MEASURES FOR GROUPS THREE AND FOUR ON LEVELS I AND II OF SOCIAL NONVERBAL BEHAVIOR AND APPROPRIATE PLAY

Group Three	Social Nonverbal		Appropriate Play	
	I	II	I	II
Before treatment	1	1	18	10
After treatment	4	3	41	11
Group Four				
Before treatment	7	1	32	8
After treatment	8	5	37	17

TABLE 2

GROUP 2 AND 3 INDIVIDUAL AND AVERAGED MULTIPLE RESPONSE MEASURES.
PER CENT OCCURRENCE OF EACH BEHAVIOR IS TABLED FOR BEFORE (B),
AFTER (A) AND LATEST FOLLOW-UP MEASURES.

	Self-Stimulation			Echolalia			Appropriate Verbal			Social Nonverbal			Appropriate Play		
	B	A	F	B	A	F	B	A	F	B	A	F	B	A	F
Group 2	48	13	14	00	01	00	00	00	00	00	03	03	08	41	47
Taylor	74	32	11	00	01	00	00	00	00	00	00	03	01	05	38
Mike	16	06	27	00	01	00	00	00	00	00	06	02	17	56	39
Jose	53	01	04	00	01	00	00	00	00	01	02	03	07	62	65
Group 3	09	10	15	05	04	01	03	09	12	02	06	06	28	52	43
Leslie	12	04	19	10	11	01	03	12	16	03	10	11	47	58	43
Tito	02	15	08	01	02	01	01	05	18	00	01	02	07	42	51
Seth	12	12	18	04	00	00	05	11	02	03	08	04	31	56	36

TABLE 3

RANDOMLY DRAWN PAIRS OF OBSERVERS' RECORDINGS FROM THE FIRST GROUP OF CHILDREN

Child, date	RICKY - 7/16/64						BILLY - 6/25/64						PAM - 4/1/65					
Condition	Alone		Attending		Inviting		Alone		Attending		Inviting		Alone		Attending		Inviting	
Observer	Joan	Gail	Joan	Gail	Joan	Gail	Gail	Irene	Gail	Irene	Gail	Irene	Diane	Joan	Diane	Joan	Diane	Joan
Tantrums	0	0	2	2	1	2	0	6	0	0	1	0	0	0	0	0	3	0
Self-stimulation	25	25	7	7	15	14	3	5	2	1	2	1	30	27	16	11	6	1
Vocalization	0	0	5	4	1	1	11	14	6	6	8	9	0	4	0	0	1	1
Echolalia	0	0	0	0	1	1	0	0	0	0	0	0	8	3	1	0	7	9
Appropriate Verbal	-	-	0	0	2	2	-	-	0	0	0	0	-	-	3	1	11	13
Social Nonverbal	-	-	0	0	15	11	-	-	0	0	3	3	-	-	46	54	16	19
Physical Contact	-	-	0	0	0	0	-	-	0	5	1	1	-	-	7	7	1	6
Appropriate Play	18	20	28	31	45	45	7	7	6	2	22	22	14	12	73	63	31	36

Table 4

TAPE AND IN VIVO COMPARISONS OF

"BEFORE" AND "AFTER" MULTIPLE-RESPONSE MEASURES

	JOSE				MICHAEL				RICKY			
	Tape		In Vivo		Tape		In Vivo		Tape		In Vivo	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Self-stimulation	33	0	53	1	11	1	18	6	10	15	25	13
Appropriate Verbal	0	0	0	0	0	1	0	0	1	2	0	3
Echolalia	0	2	0	1	3	6	0	1	1	3	1	2
Social Nonverbal	0	1	1	2	1	2	0	6	1	2	0	2
Appropriate Play	6	54	7	62	24	46	17	56	33	52	16	26

FIGURE CAPTIONS

Figure 1. Before (B) and After (A) multiple response measures averaged over all conditions for the four groups. Per cent occurrence of each behavior is plotted on the ordinate. "E" refers to the average results for the echolalic children, "M" to the average results for the mute children, and "T" to the average results for the total group.

Figure 2. Monthly multiple response measures for the first group. Rick and Pam's data are presented on the left, and Chuck and Billy's data are presented on the right. The top part of the figure shows changes in verbal behavior, and the bottom part shows changes in nonverbal behavior. Data is averaged over two month periods.

Figure 3. Monthly recordings of the first group's social nonverbal and verbal behavior presented separately for the attending and inviting conditions. Data is averaged over two month periods. Per cent occurrence of each behavior is presented on the ordinate.

Figure 4. Monthly recordings of verbal behavior presented separately for the attending and inviting condition for each of the first four children. Per cent occurrence of the behavior is presented on the ordinate. Data is averaged over two month periods.

Figure 5. Monthly multiple response measures for the second group. Per cent occurrence of each behavior is plotted on the ordinate. Data is averaged over three month periods.

Figure 6. Before and After multiple response measures for Groups 3 and 4.

Data for Group 3 are presented on the left, and for Group 4 on the right. Per cent occurrence of the behaviors is plotted on the ordinate.

Figure 7. Multiple response follow-up measures. Per cent occurrence of the various behaviors is plotted on the ordinate for Before (B) and After (A) treatment, and for the latest follow-up (F) measures. "I" refers to the average results for the four children who were institutionalized, and "P" refers to the average results for the six children who were discharged to their parents' care. Per cent occurrence of the behaviors is presented on the ordinate.

Figure 8. Multiple response measures for Rick and Pam presented Before (1964) and After (1964) treatment, and for the first follow-up (1968), second treatment (1968), and second follow-up (1970). Per cent occurrence of the behaviors is presented on the ordinate.

Figure 9. IQ scores Before (B) and After (A) treatment. Dotted lines indicate the patient was untestable prior to treatment.

Figure 10. The acquisition of agreement between observers 7, 8 and 9. Per cent deviation from the mean of the three observers' scores is plotted on the ordinate for the last six sessions. Per cent deviation is averaged over all conditions and behaviors for a given O for each session.

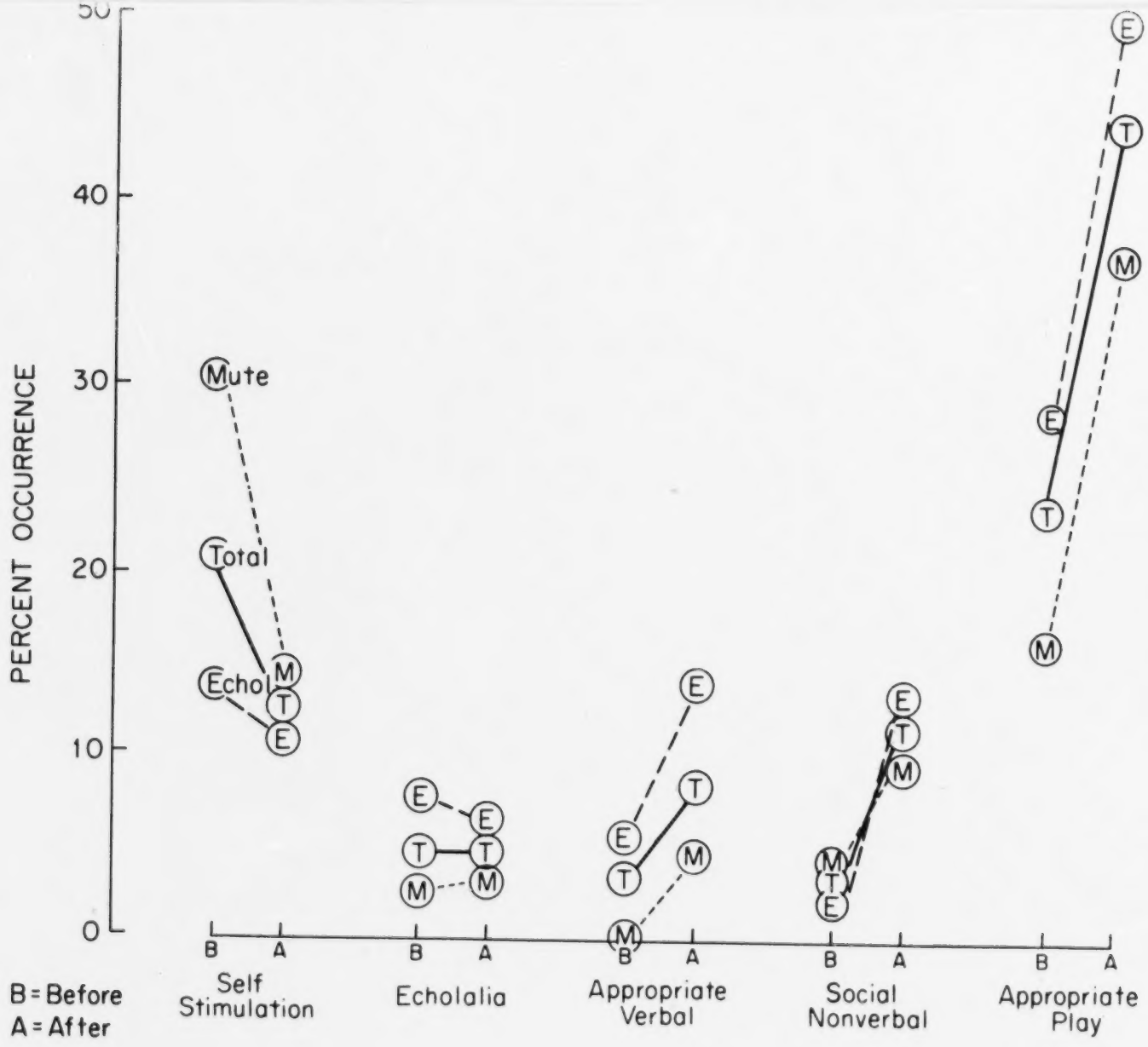

Figure 1. Before (B) and After (A) multiple response measures averaged over all conditions for the four groups. Per cent occurrence of each behavior is plotted on the ordinate. "E" refers to the average results for the echolalic children, "M" to the average results for the mute children, and "T" to the average results for the total group.

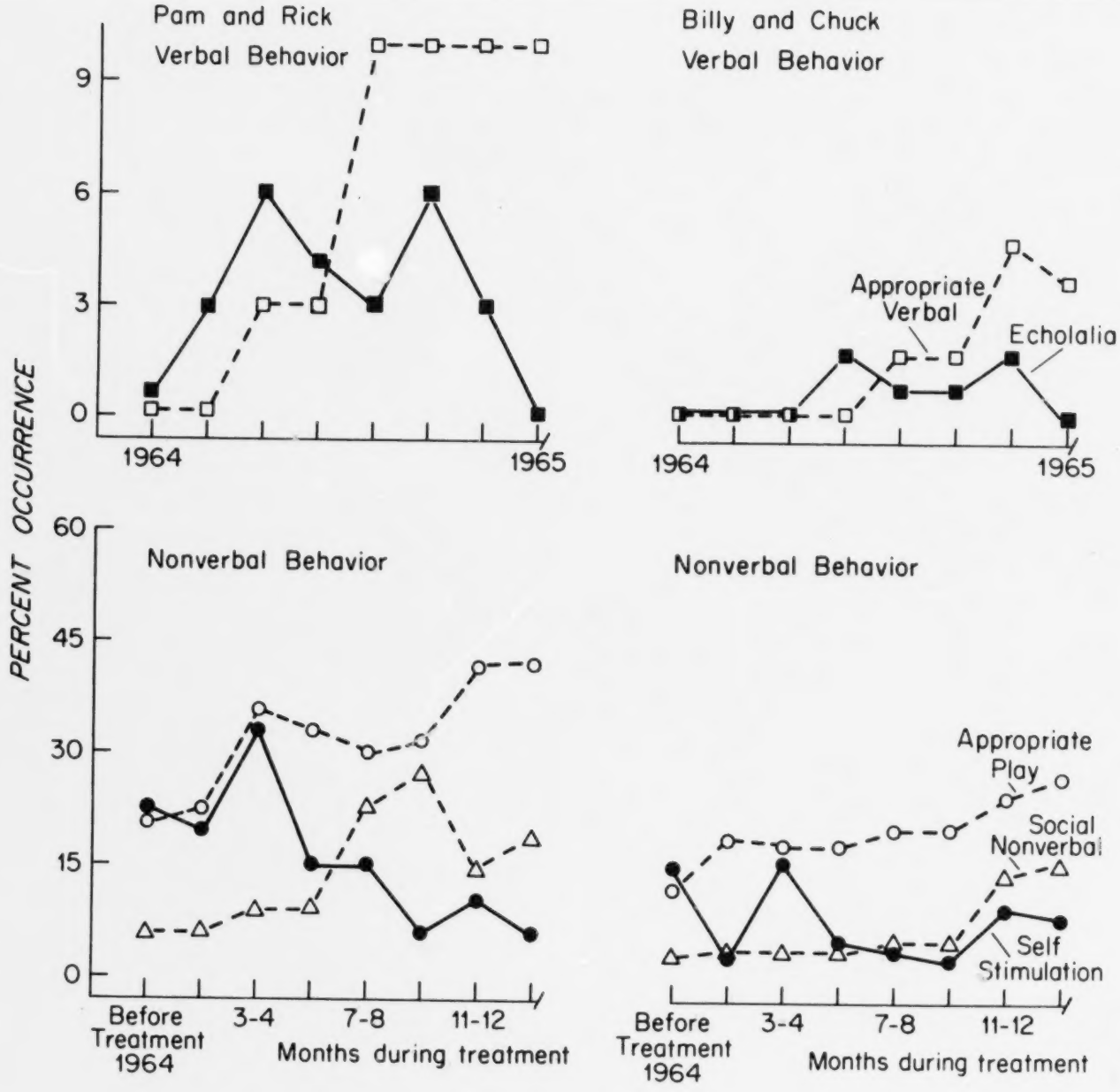

Figure 2. Monthly multiple response measures for the first group. Rick and Pam's data are presented on the left, and Chuck and Billy's data are presented on the right. The top part of the figure shows changes in verbal behavior, and the bottom part shows changes in nonverbal behavior. Data is averaged over two-month periods.

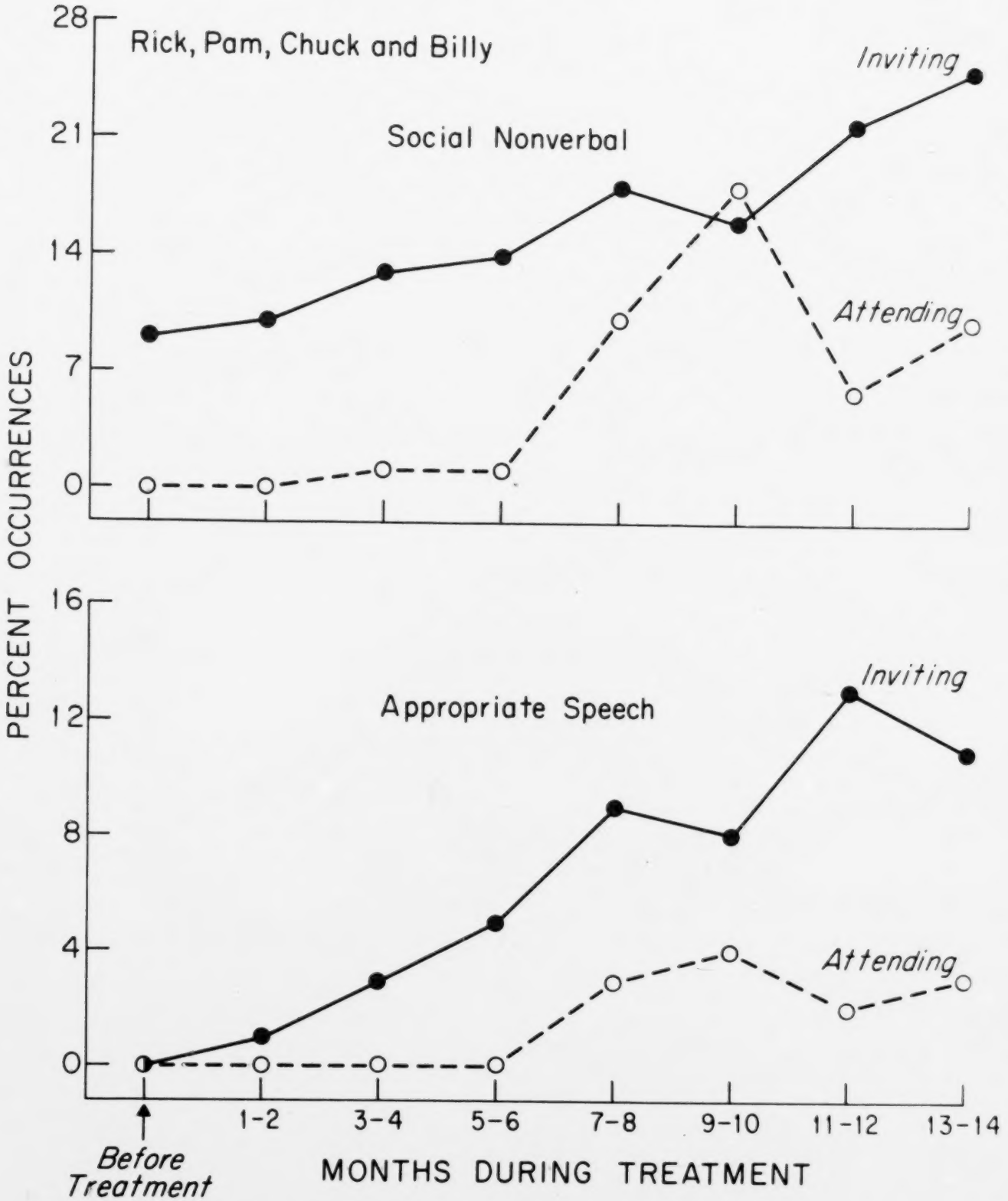

Figure 3. Monthly recordings of the first group's social nonverbal and verbal behavior presented separately for the attending and inviting conditions. Data is averaged over two-month periods. Per cent occurrence of each behavior is presented on the ordinate.

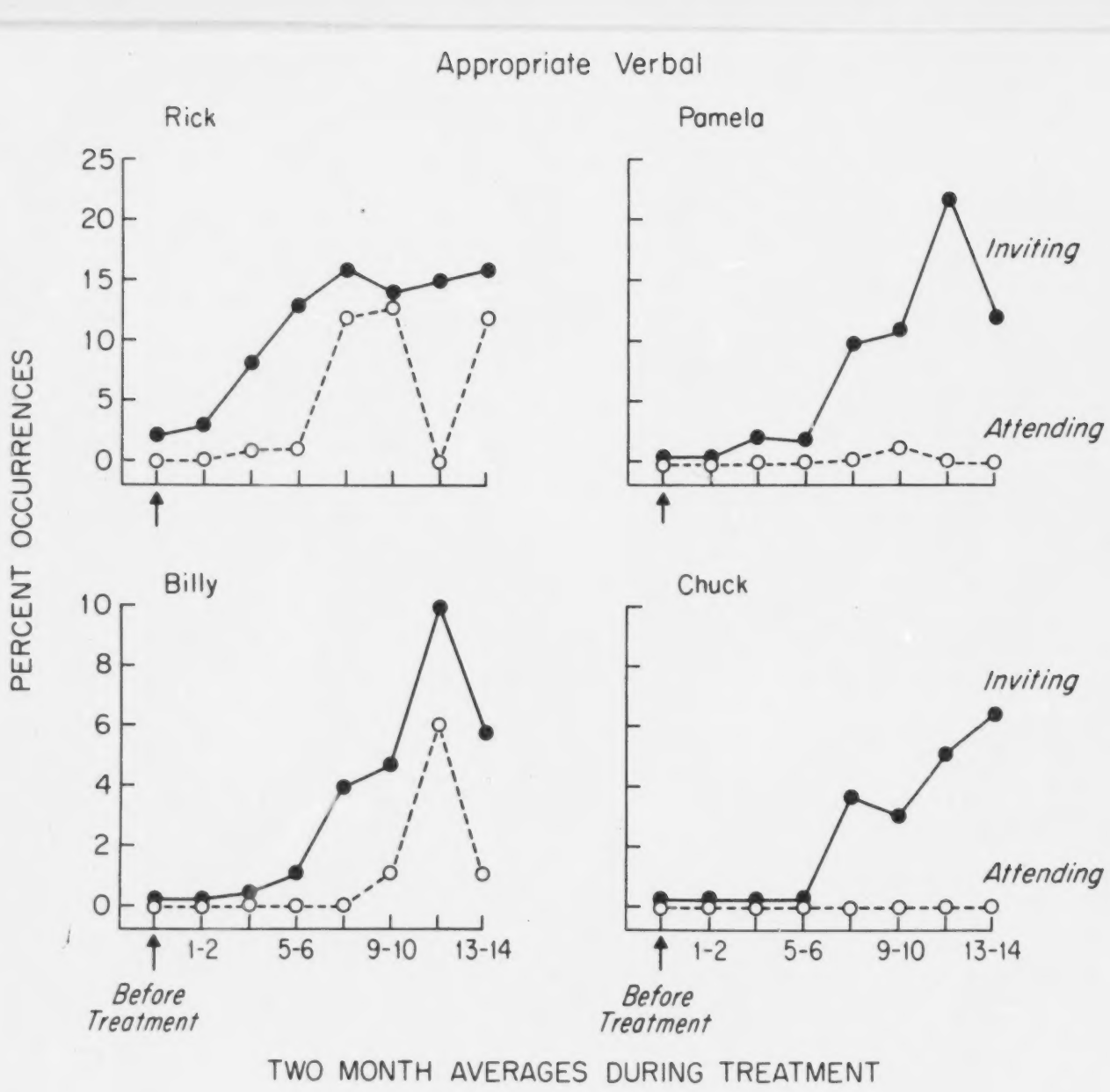

Figure 4. Monthly recordings of verbal behavior presented separately for the attending and inviting condition for each of the first four children. Per cent occurrence of the behavior is presented on the ordinate. Data is averaged over two-month periods.

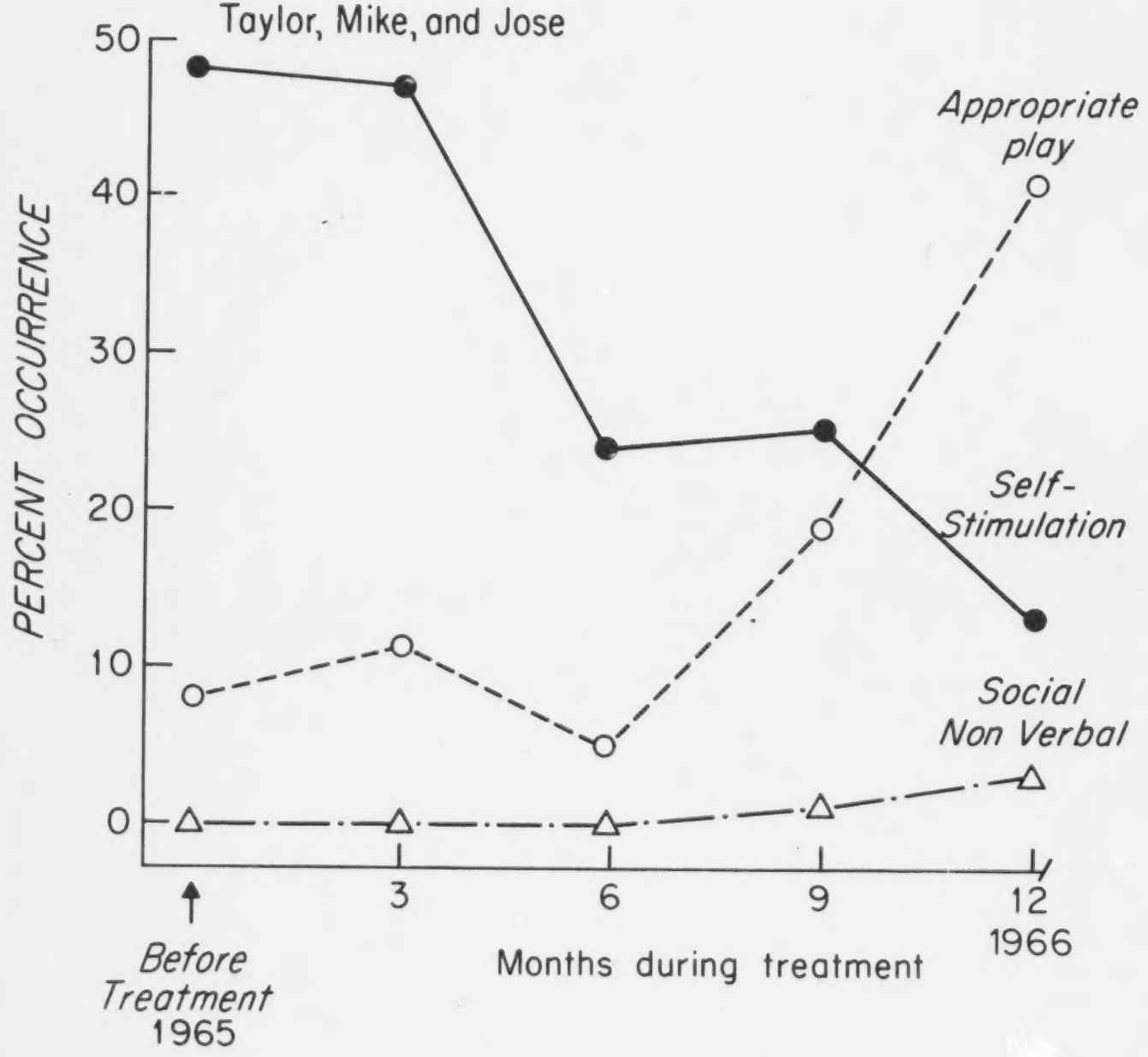

Figure 5. Monthly multiple response measures for the second group. Per cent occurrence of each behavior is plotted on the ordinate. Data is averaged over three-month periods.

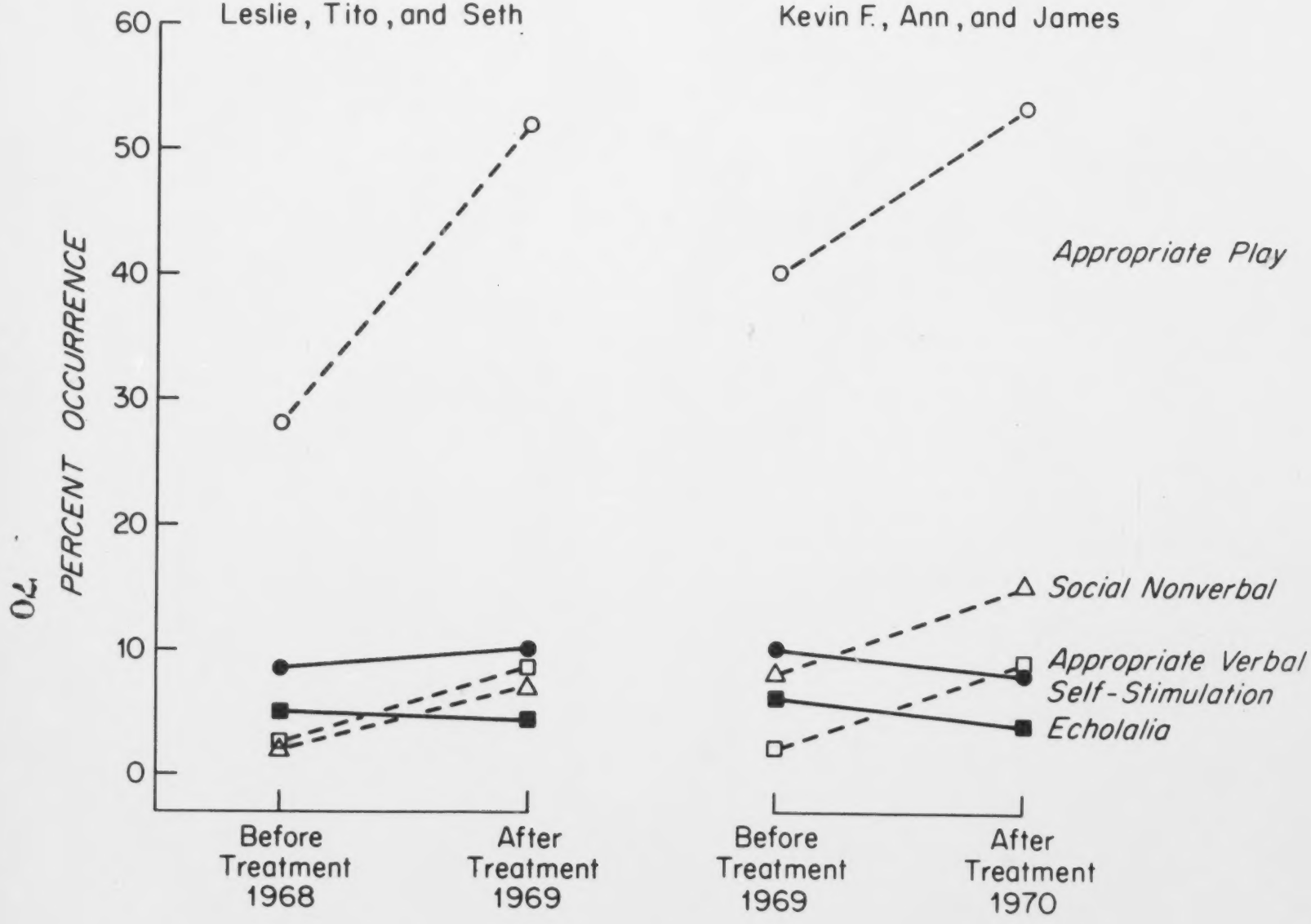

Figure 6. Before and After multiple response measures for Groups 3 and 4. Data for Group 3 are presented on the left, and for Group 4 on the right. Per cent occurrence of the behaviors is plotted on the ordinate.

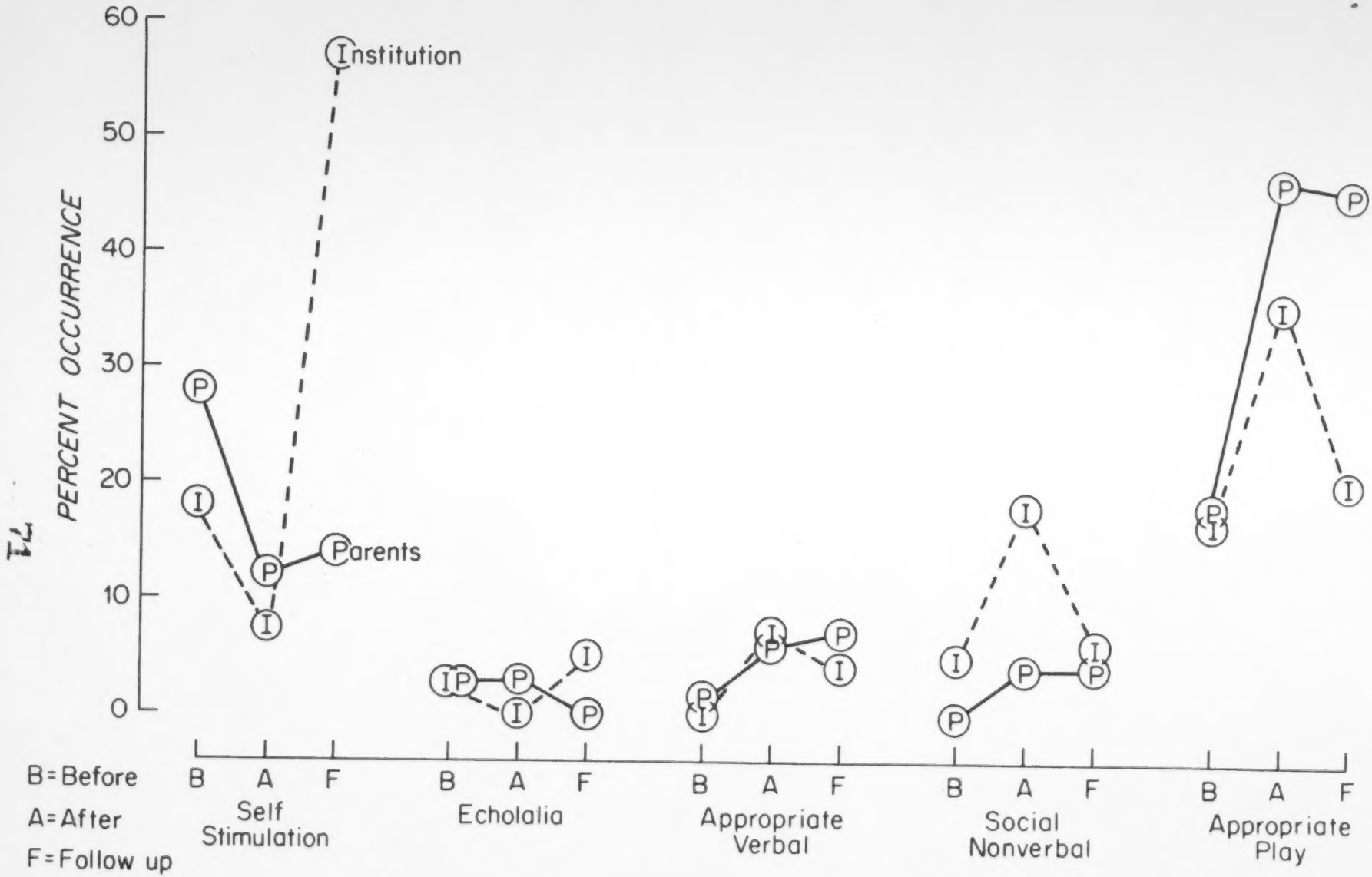

Figure 7. Multiple response follow-up measures. Per cent occurrence of the various behaviors is plotted on the ordinate for Before (B) and After (A) treatment, and for the latest follow-up (F) measures. "I" refers to the average results for the four children who were institutionalized, and "P" refers to the average results for the six children who were discharged to their parents' care.

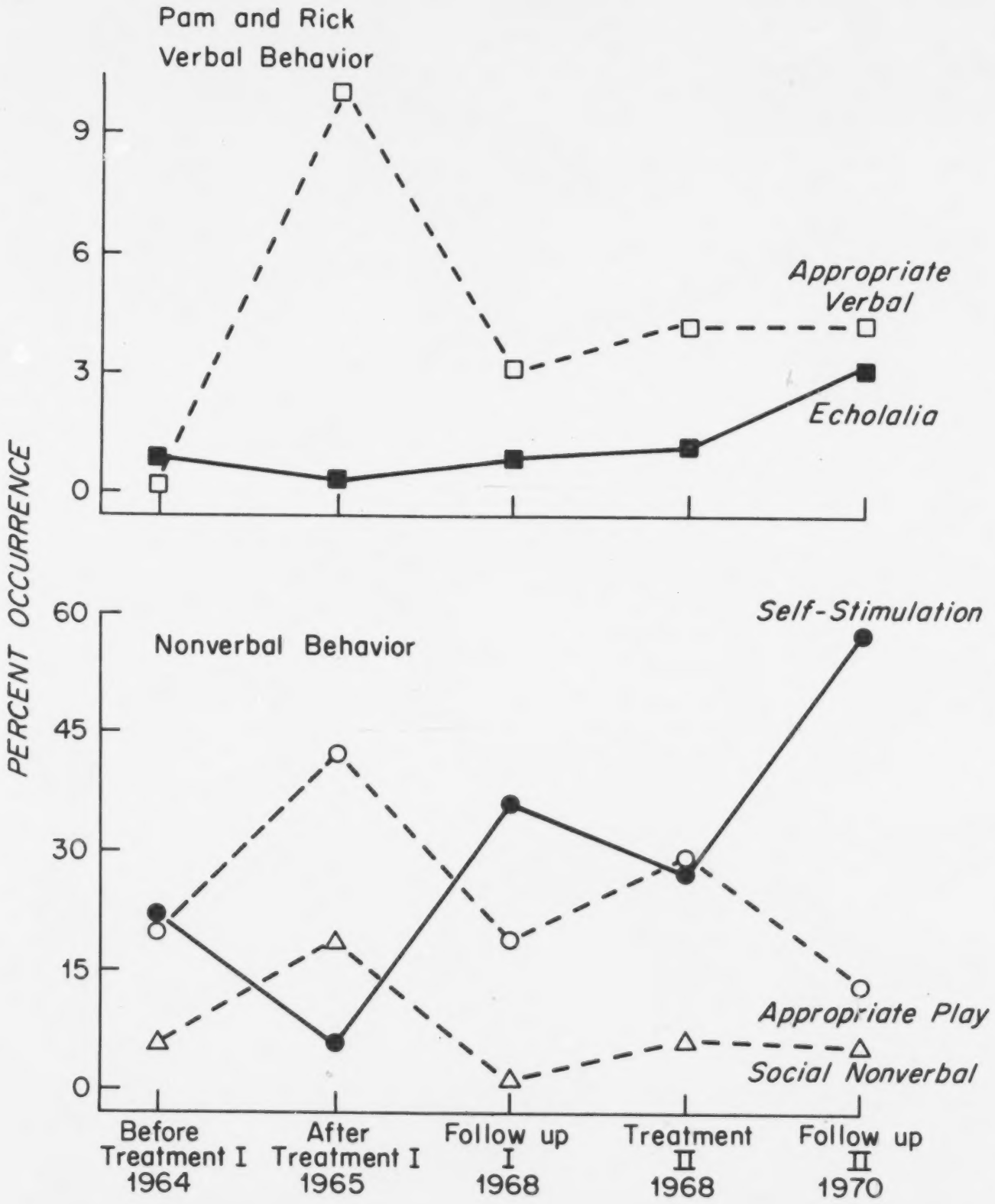

Figure 8. Multiple response measures for Rick and Pam presented Before (1964) and After (1964) treatment, and for the first follow-up (1968), second treatment (1968), and second follow-up (1970). Per cent occurrence of the behaviors is presented on the ordinate.

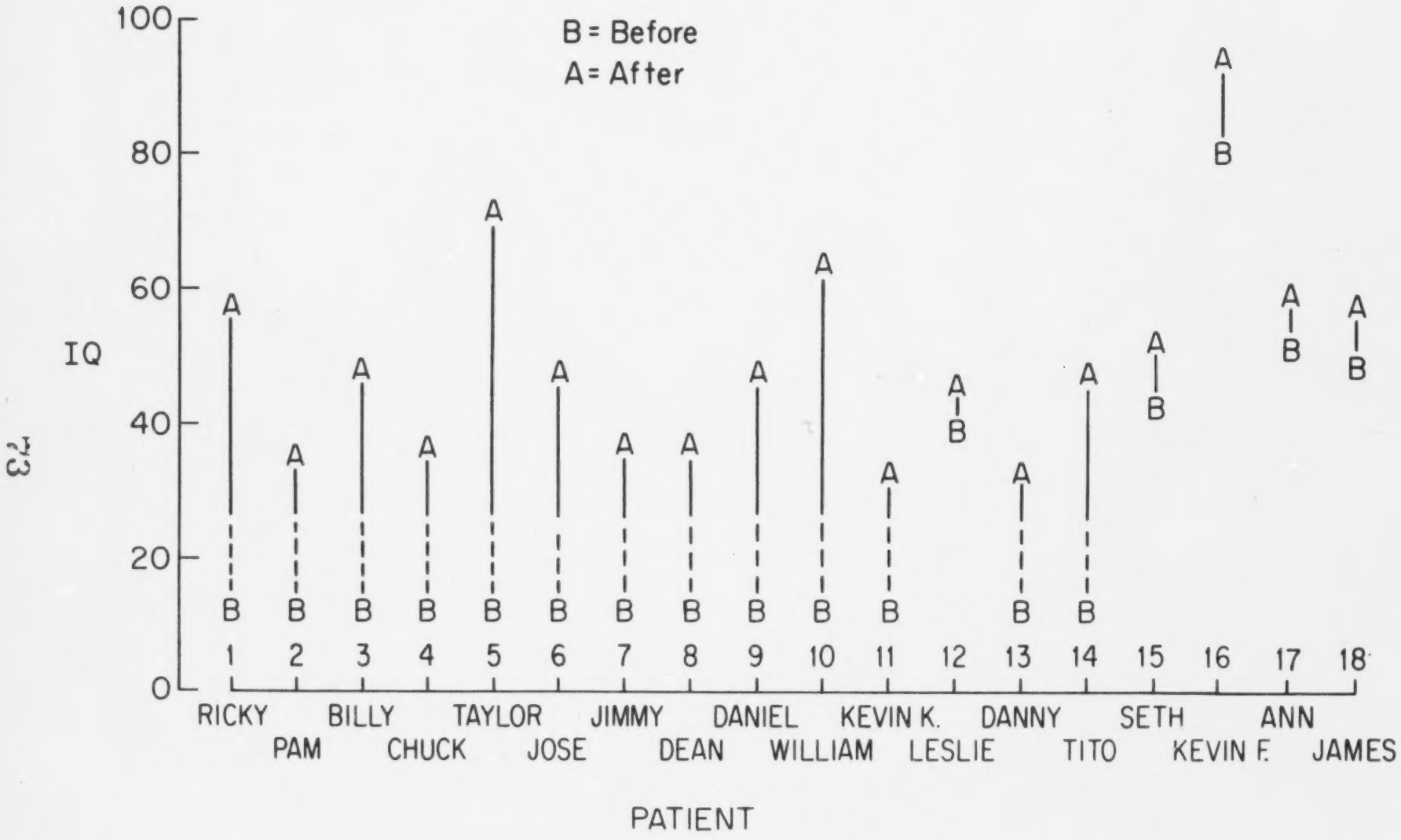

Figure 9. IQ scores Before (B) and After (A) treatment. Dotted lines indicate the patient was untestable prior to treatment.

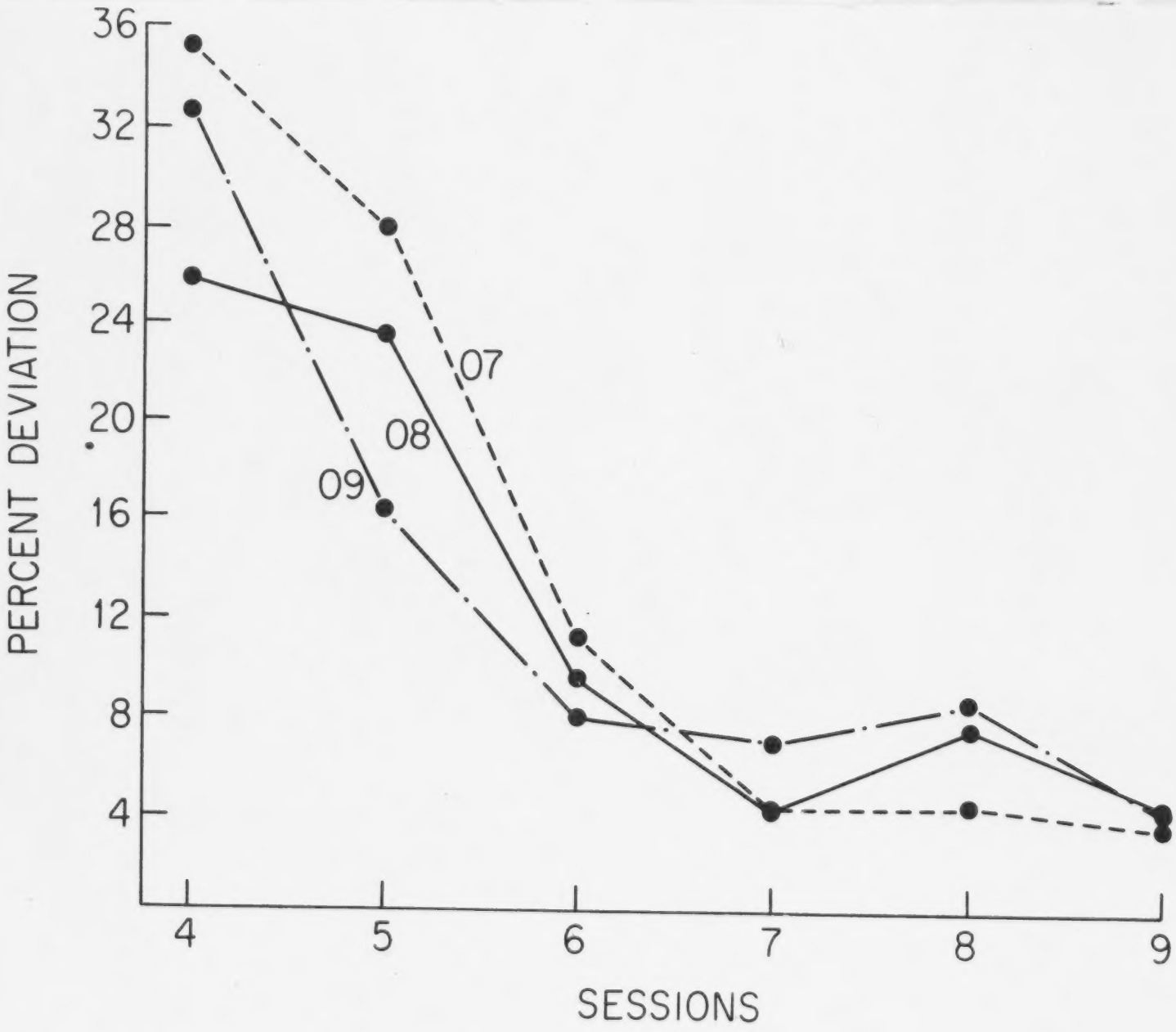

Figure 10. The acquisition of agreement between observers 7, 8 and 9. Per Cent deviation from the mean of the three observers' scores is plotted on the ordinate for the last six sessions. Per cent deviation is averaged over all conditions and behaviors for a given 0 for each session.